SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXIX.—No. 12. [NEW SERIES.] NEW YORK, SEPTEMBER 21, 1878. [$3.20 per Annum. [POSTAGE PREPAID.]

ELECTRIC LIGHTING.

It has long been known that the electric light, in point of brilliancy, beauty, and safety, far transcends all other known means of artificial illumination; but its great cost, together with the skill required to manipulate it, has, until within a short time, hindered its use except in the lecture room or laboratory. Of late years, however, machines have been devised that convert dynamic energy, with very little loss, directly into electric energy, affording, for the purpose of lighting, an inexpensive source of electricity, so that the luxury of the electric light is not only brought within reach of many, but is actually made much cheaper than any other means of illumination where light of equal power is required.

The illustration given below represents a machine shop lighted with one of these splendid lights. The apparatus used is the invention of Hiram S. Maxim, M.E., of this city.

The machine in the foreground is a dynamo-magneto-machine, which converts dynamic energy, as derived from a suitable motive power, into electrical energy, by the agency of magnets. This machine requires 1½ horse power to drive it. It weighs 300 lbs., and produces a light of from 1,200 to 2,000 sperm candles, according to speed. The magnets are similar in form to those used by Dr. Siemens, of London, but the armature, or revolving portion, is of a new design, which is said to be free from many objections common to other machines. The only points where any considerable wear takes place on these machines is in the commutator, in which a stationary copper brush takes the current from the revolving part.

In some machines this portion has been built into the machine, so that when it is worn the whole machine would require rebuilding in case of repair. Mr. Maxim has constructed his machine so that the removal of a nut loosens the parts subjected to wear, so that they may be replaced in a few minutes, and at a trifling cost.

This dynamo-machine is simple and requires no more attention than a fan blower or emery wheel. It may be placed in any convenient locality, and the wires for conveying the current may run almost any distance to the light-apparatus.

In this machine no acids or chemicals are used. A bundle of iron and copper revolving between two electro-magnets generates at first a slight current, which reacts upon the magnets and upon itself until a very powerful current results. It may be said that a dynamo-machine forces or induces a current of electricity through a wire very much as a fan blower forces a current of air through a pipe. Connect the outlet and inlet of a fan blower, and a current of air will circulate in proportion to the speed at which the fan is run. Connect a wire from the positive to the negative of a dynamo-machine, and a current of electricity is set up, which is very nearly in proportion to the speed of the machine. If the wire should be cut the current would cease, the same as the current of air would in the blower if a valve was closed in the pipe. On breaking the circuit the power required to run the dynamo-machine would fall off from 1½ horse power to about ⅛ horse power, which is sufficient to overcome the friction. While the machine is running, touch the ends of the wires, and at once the current is re-established. Draw the wires apart slowly, and a brilliant flame of the incandescent vapors of the metal of the wire is seen, but the wire soon melts or burns away. Attach to the wires two pieces of carbon, such as is used for battery purposes, bring them together and separate them, and a beautiful white flame will appear. This is called the voltaic arc.

It will soon be seen that one of the pieces of carbon at the spot impinged by the arc becomes intensely heated, and gives off a light fully as brilliant as sunlight, and that this very brilliant carbon is wasted away much faster than the other. This (the hot one) is called the positive carbon, and is attached to the positive wire.

To maintain the light the carbons must be moved together, so as to keep the distance between them, across which the arc plays, always the same. To keep the arc always in the same position both carbons must be advanced at a rate of speed equal to their consumption. The apparatus for accomplishing this purpose is called a regulator or lamp. Many of these have been made, but few have answered the expectations of their inventors.

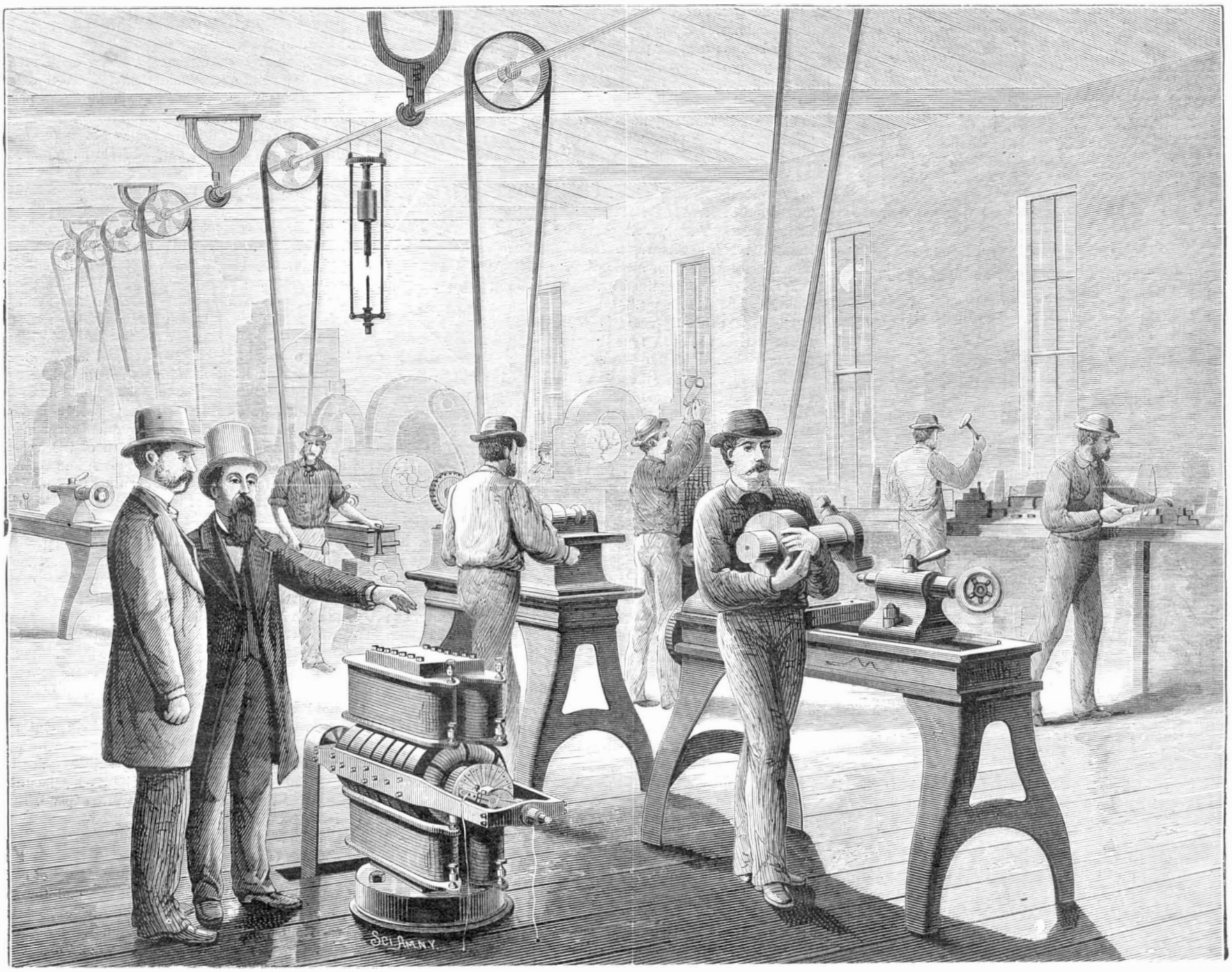
We shall refer to some recent improvements that seem to operate remarkably well.

Fig. 2, page 178, represents a vertical central section of a lamp lately produced by H. S. Maxim. Fig. 3 is a perspective view of the same, and Fig. 4 a detail. A is the positive carbon carrier, and B the negative.

The operation of this lamp is as follows: The negative carbon, which may be 6 inches long, being secured in the lower holder, B, the top holder may be drawn up, as the pinion that gears into its rack is free to turn in that direction without driving the train of gears. A carbon 11 inches long may now be inserted in the top holder, and its point brought in line with the lower carbon by moving the lever on the back side of the carrier.

The wires being connected to the binding post (one on each side of the lamp), the thumb nut, G, being turned will allow the weight of the positive carrier to rotate the train of gearing, and by winding up a cord to draw the negative upward until the combined movement of both causes the points of the two carbons to meet. This will establish an electrical contact, and the current will at once commence to pass, the electro-magnet in the bottom of the lamp will become excited and draw downward the two armatures, one of which draws down one end of the cord that supports the negative carbon, and the other locks the gearing. The separation of

[*Continued on page* 178.]



NEW ELECTRIC LIGHT APPARATUS.—BY H. S. MAXIM, M. E.

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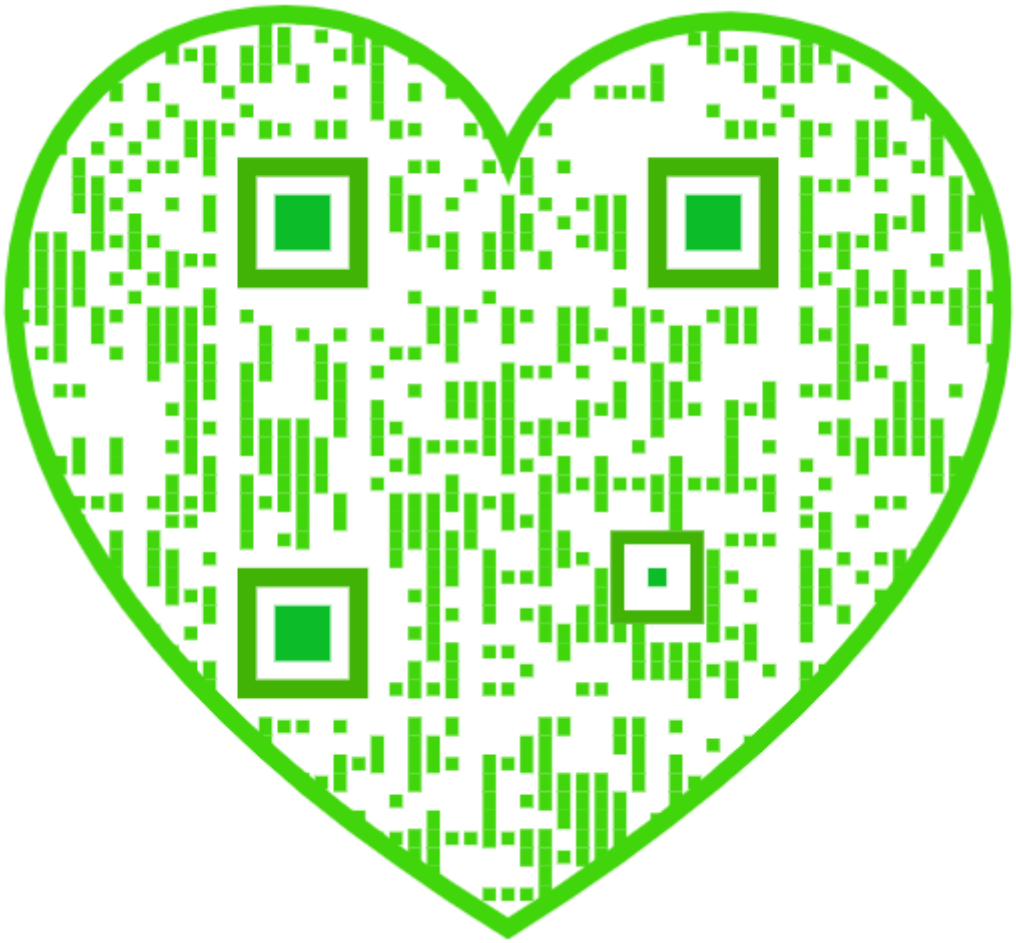

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

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VOL. XXXIX., No. 12. [NEW SERIES.] *Thirty-third Year.*

NEW YORK, SATURDAY, SEPTEMBER 21, 1878.

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V. ELECTRICITY, LIGHT, HEAT, ETC.—Electric Lamps in Paris. By Professor SILLIMAN. History of electric illumination. The Gramme machine. Cost of the electric light.

How to make a Working Telephone. By GEO. M. HOPKINS. Full practical directions, with six full size drawings to scale, enabling any person to construct a working telephone line complete at small expense.

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VI. MEDICINE AND HYGIENE.—Diphtheria caused by Bad Sewerage at Pittsburgh, Pa. Synopsis of a paper read before the Pittsburgh Academy of Medicine. By Dr. SNIVELY, with map of the infected district and description of the sewer defects, etc.—Diphtheria. Period of life most liable to diphtheria, with statistics. Diphtheria the type of preventable disease.—Points connected with Diabetes. A lecture delivered at the Royal College of Physicians. By F. W. PAVY, M.D., F.R.S.

Danger from the Injudicious Use of Alcohol in the Sick Room. A paper read before the Hartford County Society. By T. D. CROTHERS, M.D. Numerous cases of inebriety resulting from alcoholic prescriptions, etc., with valuable suggestions for the safe medical use of alcohol.

Histology and the Cellular Theory. By Dr. EDOUARD FOURNIE. No. III. Cells live but do not perform function. The ovule and the cell.

The Art of Preserving the Eyesight. From the French of Arthur Chevalier. No. IX. Colored glasses and their uses, with 4 figures.

THE ORIGIN OF AMERICAN MECHANICAL GENIUS.

The London *Times* of August 22 prefaces a long account of the American mechanical display at Paris with the following remarks:

"It may almost certainly be predicated of any modern mechanical congress that the Americans will carry off the palm for novel and ingenious application of force to practical purposes, the substitution of mechanism for hand labor in new and curious contrivances, which, to the amateur in such matters, surprise as much by the new ways in which old problems are attacked as by the fine way in which the work is done. The mass of invention and practical result from it produced by the Americans within the century, and especially the last 20 or 30 years, is so great and so important in results, that it presents an important problem in political economy—one especially interesting to Englishmen, as American mechanism is an offshoot from English, but an offshoot so peculiar in its character that mere heredity will not quite explain it.

"A traveler in the New World once said that the most interesting thing in America was its Americanism, and so we may say that the most curious feature of American mechanics is its distinctively American feature. As mechanical science progresses, the greater and more important inventions become elaborated by, and the property of, the nation who push that science furthest in its experimental studies. The result is foreseen, studied, and developed with method and certainty, and great industrial revolutions are effected with a certain and almost calculable progress. In this progress England has long led, and still leads, the world, owing to favorable conditions of capital and labor. Fulton built the first successful steamer on American waters; but all the latest and most important advances in steamship building are English, and the great mass of the steamers afloat are English. The first monitor was American; but the puny craft of that construction across the Atlantic would all go down before one of the last English build; and though Rodman and Dahlgren instituted the experiments to which we owe most of the present knowledge of the power of artillery and gunpowder, English artillery has left the practical transatlantic results out of the chance of competition.

"Yet in spite of this the activity and insight of the American inventive genius develop more that is new and practical in mechanism than all Europe combined. The New Englander invents normally; his brain has a bias that way. He mechanizes as an old Greek sculptured, as the Venetian painted, or the modern Italian sang. A school has grown up whose dominant quality, curiously intense, wide spread, and daring, is mechanical imagination. It is not the professed mechanic or iron master who invents, any more than the schoolmaster or the farmer. As Tintoretto left his dyeing to become a great painter, the American, be he bank clerk, pedagogue, backwoodsman, or plowman, turns in his busy brain some problem of his own, suggested by his experience of ill or too slowly done work, and like Archimedes in his bath, he suddenly finds it and rushes away with his 'Eureka' to some place where he can make his model or get it made—more frequently the former for want of funds to get it made. There was a want the man had felt, an ideal to be worked out, and in his meditation suddenly the thing flashed on him, and is complete in all its essential parts from that moment. The number of inventions, useful and useless, thrown off in this way in the course of a year, of which only a small proportion attain the realization of the Patent Office, can only be imagined by those who have lived among New Englanders at home."

The *Times* evidently uses "New Englander" to represent the inventive American type, not merely the men who live to the eastward of the Hudson. That type of creative thinkers prevails across the entire breadth of the States; and every year sees its development more and more to the southward. Why? It will not suffice to say that the American has a bias toward invention. How came he to have such a bias? Not by inheritance surely, for his ancestors in Europe were not distinguished that way. Not because he came of good stock, and was early thrown on his own resources, with a new world to conquer before him. The colonizing of new lands by a free and vigorous people has happened many times in the world's history, but a race of inventors never appeared before. Scarcity of labor could not have been the original cause; for in all other similar cases the result has been a natural limitation of the amount of work attempted, not a phenomenal increase of achievement through invention. No doubt these, and other conditions favorable to the development of personal vigor and individuality of character, have helped to cultivate the faculty of creative mechanical imagination, which, in its intensity, universality, and daring, has become the distinctive American characteristic. But they cannot be the mainspring of American inventiveness, for the simple reason that they are not distinctively American in origin, or more generally prevalent here than in other regions not remarkable for the inventive genius of the people.

There is a factor, however, which was early brought to bear upon the industrial development of American thought—a factor to whose influence American inventions can be directly traced in almost every instance; a factor distinctively American in spirit and character. That is the American patent system. If America has led the world in the evolution of new and useful ideas, it is because America was the first to see the need of, and to practically recognize the justice of, a liberal recognition of the rights of property in new ideas. It was very early discovered in consequence that one of the quickest ways to wealth and honorable fame was through creative thought; and creative thinking became as a natural result the desire and aim of all classes of our people. The American, whatever his calling, is forever on the outlook for novelty, and thousands make invention the business of their lives, because there is money in it. A patent costs little and may bring a fortune; and the stimulus thus provided has made every American workshop an industrial school, more and more, every year, striving for the grand prize—a profitable patent. It was this feature of American life which so forcibly impressed the foreign commissioners to the Centennial Exhibition—which made them all so eager on their return to have their home governments imitate the American Patent System. The contrast between America and Europe on this score has been enormously diminished by the new laws of our European rivals. And though, in liberality to inventors, our system still bears the palm, it may be well worth while to consider whether we cannot profitably increase the incentives offered to inventors—especially inventors with little capital—and so make sure of maintaining the lead which liberality has thus far secured to this country.

After the foregoing was written and in type, the copy of the *Times* from which the quoted extract was taken came to hand. A paragraph not given in the early report happily justifies the explanation we have offered as to the fundamental condition of American inventiveness. In it the *Times* goes on to say:

"There can be no question that the efficiency and moderate cost of patent right protection in America should have the greater share of the credit of this immense activity. Invention pays, and the action of the patent laws is so secure and equitable that the investment in brain labor is a safe one, while the expense of securing a patent is so small that the capital required for preliminary enterprise is within reach of almost every inventor. A patent right is the El Dorado of the New Englander, and thousands delve there with an assiduity no mere love of invention could inspire. This is not conjecture or *a priori* conclusion, but opinion based on years of intercourse with the inventing Yankee, and actual experience of the working of the American patent system, which, if not perfect, is so far in advance of that of any other country that we may safely say that never has wisdom in legislation more completely brought its own reward. The economy of wages from labor saving machines in the United States is almost incalculable, while the tax for royalties on patents taken out in England alone must constitute an important item in the finances of American industry."

THE UTILIZATION OF WEEDS.

Ralph Waldo Emerson has described weeds as plants whose use has not been discovered. Too often men are content to call a plant a weed and then proceed to exterminate it without making any attempt to find out its possible uses. An Indian writer, Mr. George W. Strettell, considers from his experience gained in the Indian Forest Department that a large revenue might be derived from such plants, especially those yielding fiber—plants which require no care in cultivation, which will grow in land utterly unsuited to any other crops, and which yield fiber practically proved to be well adapted to the manufacture of paper and textile fabrics. He advocates the cultivation, at first if need be experimentally, and on a small scale, of several different plants, and especially of one, the *Calotropis gigantea*. The fiber of this plant has been pronounced by paper makers and manufacturers of textile fabrics as excellent; and he shows convincingly that after allowing for the cost of cultivation and of extracting the fiber, the raw material might be sold at such a price as to add considerably to the Imperial revenue.

Next to the discovery of plants yielding products now in demand for industrial or medical purposes, we may rank the invention of new uses for the products of plants now considered useless. But a small portion of the vegetable world has yet been made tributary to man; and from past experience it is safe to predict that even the most noxious of weeds may yet prove to be of the highest utility.

MENTAL EXPERIMENTING.

The reduction of experiment to a mental operation is a wonderful faculty possessed by some men. They are able to plan and arrange the parts of a machine, the steps in a process, or the intricacies of a design by a purely mental act, so that when the device is embodied in matter it is the exact representation of the thing pictured in the mind. This rare faculty is not wholly a gift, as it may be acquired to a greater or less degree, and there appears no reason why it should not be more generally possessed.

The one who at the first mental inception begins to put the subject of his thoughts into tangible form by experimenting with material things, not only adds expense to his experiment, but at the same time cripples his faculties by failing to give them the opportunity to expand, as they might have done had not the effort been complicated by physical action.

The patience of inventors too often and too easily is overcome by their great desire to see the embodiment of an idea, hence the crude and imperfect inventions, and the rough, unshapely, and unscientific machines, which exist but for a brief period, and are afterward to be found disorganized and laid away, covered with dust, corrosion, and cobwebs, the evidences of disuse.

The best proofs of the lack of the sort of mental work we

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have referred to are found in the heaps of old iron awaiting remelting at the foundry or in the junk shops, where many of these inoperative machines ultimately find lodgment. Many of these machines evince mistakes and miscalculations which can be accounted for only on the ground of incapacity or an almost entire lack of thought.

Of course every one exercises a certain amount of forethought previous to any act; but we refer to that intense and systematic application of the mind to a subject which revolves it, analyses it, and puts it in all possible forms, and finally perfects it, so that when it is put into tangible form it will fulfill the expectations of the originator, without the necessity of reconstruction or material alteration.

SENATE BILL NO. 300.

At the request of Mr. W. C. Hill, Clerk of the Senate Committee on Patents, we take pleasure in saying that copies of Senate bill No. 300, with amendments, can be had by applying to him at Washington. We trust that our readers will not neglect to make themselves familiar with the changes therein proposed in our patent law, and their probable effects upon the industries of the country. With all its amendments the bill is, in our opinion, open to serious objections on several points; and it is to be hoped that all who have the integrity and usefulness of the system at heart will be prepared to lend a hand in the struggle over it, pretty sure to come off next winter in the committee room, if not in Congress.

The enemies of the system can hardly find a Congress so ill prepared to appreciate the object and character of patent legislation as that which threatened so much mischief to the industries of the country last winter. Still the risk is not small; and our inventors, farmers, artisans, and manufacturers should see to it that their representatives are properly instructed with regard to the nature and use of the Patent Office, before they return to Washington. Especially should they be made to see the criminal folly of any changes calculated to increase the cost of patents, to shorten their life, or to make them less easy to get.

THE BRITISH ASSOCIATION.

The forty-eighth annual meeting of the British Association for the Advancement of Science was held in Dublin, the week ending August 21. Though there was nothing in the matter brought before the meeting calculated to make it specially memorable, it was above the average in general interest.

The President, Dr. Spottiswoode, seems to have pitched the keynote of the meeting in his very able address, and throughout the proceedings there was a notable absence of everything sensational or provocative of controversy. Among the more important papers and addresses may be mentioned Professor Huxley's in the department of Anthropology. His review of the progress of thought—indeed the revolution in modes of scientific and popular thinking—in regard to man's nature, origin and history, was, to say the least, very encouraging. It does not take anything like so long now for men to become reconciled to new ideas as it used to.

The opening address of Professor Maxwell Simpson in the chemical section, on the educational influence of chemistry and the material advantages arising from its study, was decidedly forcible. The need of proving all things, of being exact, careful, circumspect, and rigorously honest in all one's chemical work, gives that science, properly taught, the highest rank for cultivating scientific habits of thinking. Professor T. Sterry Hunt's paper on the succession of the crystalline rocks is based on the results of many years of study of the crystalline rocks of this country. Professor C. Wyville Thomson's address before the geographical section; President Edward Easton's address before the mechanical section, on the Conservancy of Rivers and Streams; Mr. George J. Romaine's paper on Animal Intelligence; Sir John Lubbock's on Ant Life, and other papers of interest, we shall refer to hereafter.

Asking Impossibilities.

It would undoubtedly be a good thing for inventors if the Patent Office could be so omniscient and infallible in its action as to make its decisions in all cases indisputably correct and absolutely just. But seeing that human agencies are not apt to be blessed with such transcendent powers, it seems to us much safer for all concerned to have the Office play the more modest part now assigned it, leaving it to the courts to decide upon disputed points of priority and the like. It is true that patent litigation is tedious and expensive; but that, so far from being a valid reason for the Patent Office taking upon itself the work of the courts, as a correspondent insists it should, is a most cogent reason for its letting such work alone.

Our correspondent says:

"The poor inventor, after having, at great outlay of his time and money, perfected an improvement and demonstrated its utility, is almost sure (especially if it relate to any of the larger manufacturing interests) to have it seized upon by some unscrupulous party, who proceeds, in defiance of the patentee's rights, to reap the benefits of his labor and study, relying on his greater means and the profits accruing from the infringement to defend himself in law and stave off final judgment until the plaintiff shall seek a compromise or become discouraged and give it up altogether. Should the latter, however, be so fortunate as to win his case, he will, after all, have obtained only what he should have had at first, namely, a valid patent."

The writer labors under the very common misapprehension that it is the business of the Patent Office to confer property rights; when the truth is, its duty is rather to record claims for such rights, making such examinations as may establish the probable justness of the claims.

To undertake, as our correspondent advises, to give to each application for a patent "the most searching and exhaustive examination as to novelty and scope of claims that it is possible to make, so that the patent once issued could never have its validity questioned," would be to load the Patent Office with duties as irrelevant to its true function as the conduct of Indian affairs, the trial of pickpockets, or the management of the army and navy would be.

With two or three hundred patents a week to pass upon, any attempt of the Patent Office to usurp the functions of the courts would put it hopelessly in arrears inside of a month.

THE IMAGINATION IN THE CONSTRUCTIVE ARTS.

Without the imagination art would have no soul, and we would have nothing beyond the visible and tangible, nothing but the gross and ponderous. The accomplished artist, with a few skillful brush strokes, places shade here and light there, until to the unimaginative there are only a few patches of color which mean nothing, while in reality there are masses of light and shade which, to the artistic, are suggestive not only of the bolder elements of the picture, but also of detail which may be supplied by the imagination. In a really artistic picture there is no outline, no rigid delineation of any part, but everything pertaining to contour is soft and mellow, more suggestive than definitive, leaving much to be supplied by the creative faculties.

Fig. 1.

The portrait, Fig. 1, is composed of masses of light and shade; there are no rigid outlines, no arbitrary guides for giving form or expression to the face, yet it has form and expression, for we imagine the lines that define the face. Each person has individual, natural, and peculiar tastes which govern the imagination, and thus control the characteristics of the picture, so that two persons cannot see in it the same face, but each sees a visage that is more or less beautiful according to the bent of his fancies.

Fig. 2.

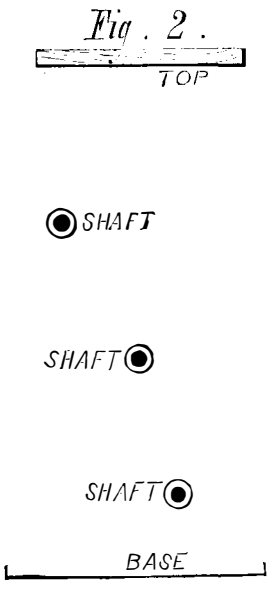
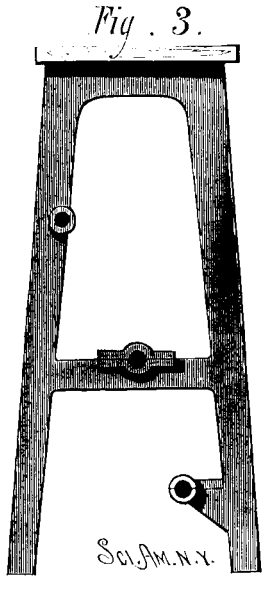


Fig. 3.



It is not in the fine arts alone that the imagination plays such an important part, for in the constructive arts this faculty is positively required. Elegance of design in architectural or engineering structures, or in machinery, is as essential as good materials or good workmanship. The builder who, through the exercise of his imaginative powers, plans and executes a beautiful structure, of necessity takes a leading position and commands his proportion of patronage; and the machine manufacturer who mixes art with his iron has the long arm of the lever when compared with others who regard weight and strength as the only requisites. To illustrate this, we will take a machine in which certain points are necessarily fixed by the location of the shafts, the base, and the top. The inartistic and unimaginative would design a frame which, for practical purposes, might answer equally as well as any other, but it would not have that comely form which results from an artistic taste and an exercise of the imagination, and which goes a long way in making a machine popular.

Fig. 4.

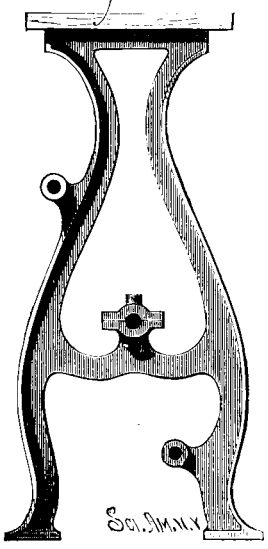
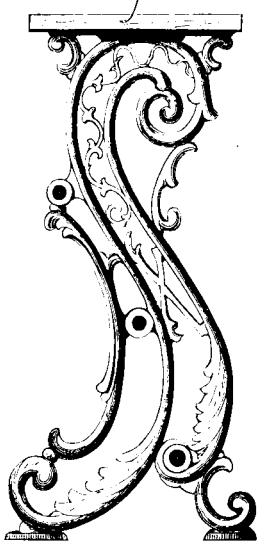


Fig. 5.



The three shafts, the top, and base of the machine under consideration are the arbitrary points. The frame must be made upon the most obvious straight lines, or the imagination must supply such a design as would, while it comprehended the bearings of the shafts, the support of the top, and the proper width of base, be also pleasing to the eye. Even though it be a thing of iron, it should have symmetry; harsh straight lines should be avoided, and angles should be rounded; in fact, it must be, in a sense, beautiful, as well as subservient to the purposes of the machine.

There are certain features peculiar to every machine which must control its design to a greater or less degree, but there is opportunity on every machine to exercise skill in this direction. There are undoubtedly extremes in the matter of design—a thing may be too ornate as well as too plain.

Fig. 2 of the example which we illustrate shows the controlling points of the design; Fig. 3, the most obvious form of frame; Fig. 4, a frame of graceful shape; and Fig. 5, a frame of scrolls. In all of these the arbitrary points are precisely the same, but the frames differ materially. That shown in Fig. 3 would answer the purpose, but who would not prefer the design in Fig. 4? The design shown in Fig. 5 might properly be considered out of character for a machine, still its appearance is pleasing.

THE BAG-WORM'S MOTHER.

In the SCIENTIFIC AMERICAN of August 24 attention was called to an article in the SCIENTIFIC AMERICAN SUPPLEMENT, of the same date, describing a curious insect. The writer, Mr. Wm. H. Gibson, after much study of the insect—variously known as house-builder caterpillar, basket worm, drop worm, bag-worm, etc.—had come to the conclusion that the female was never transformed into a moth, and never had any connection with the male.

In the next issue of the SCIENTIFIC AMERICAN SUPPLEMENT will be found an article by Professor Riley giving the true natural history of the insect—*Thyridopteryx ephemeræformis*—with a full description of the manner in which the mysterious fertilization takes place. Professor Riley has been making experiments with the silk of this moth, which lead him to the belief that the insect, now a real pest, may some day prove valuable as a silk producer.

The Supposed New Metal Mosandrum.

It will be remembered that under the name of mosandrum Mr. J. Lawrence Smith recently described the radical of an earth that he had isolated from certain American gadolinites. The French chemist, M. Marignac, a high authority in these matters, having examined specimens of the supposed new metal, sent him by Mr. Smith, pronounces them nothing but terbium. At the same time he acknowledges the fact that from the spectroscopic studies of M. Soret there must be recognized in these minerals a metal which appears to be new to science. It is not the "mosandrum" of Mr. Smith, however, but the radical of an earth isolated by M. Delafontaine, and rightly considered by him entirely new.—*La Nature.*

New Fish.

The Gloucester fishermen are rendering Professor Baird and the cause of science very valuable aid by bringing in from the fishing banks many curious kinds of fish, heretofore thrown away as of no value. In this manner much is learned concerning the presence on the grounds visited by fishermen of Arctic and European fish. The schooner Marion, Captain Joseph W. Collins, lately arrived from a bank trip, brought in three strange fish. Two were sharks, entirely new to North America, if not, indeed, to science. The other was a fish of the genus haloporphyrus, but of undescribed species.

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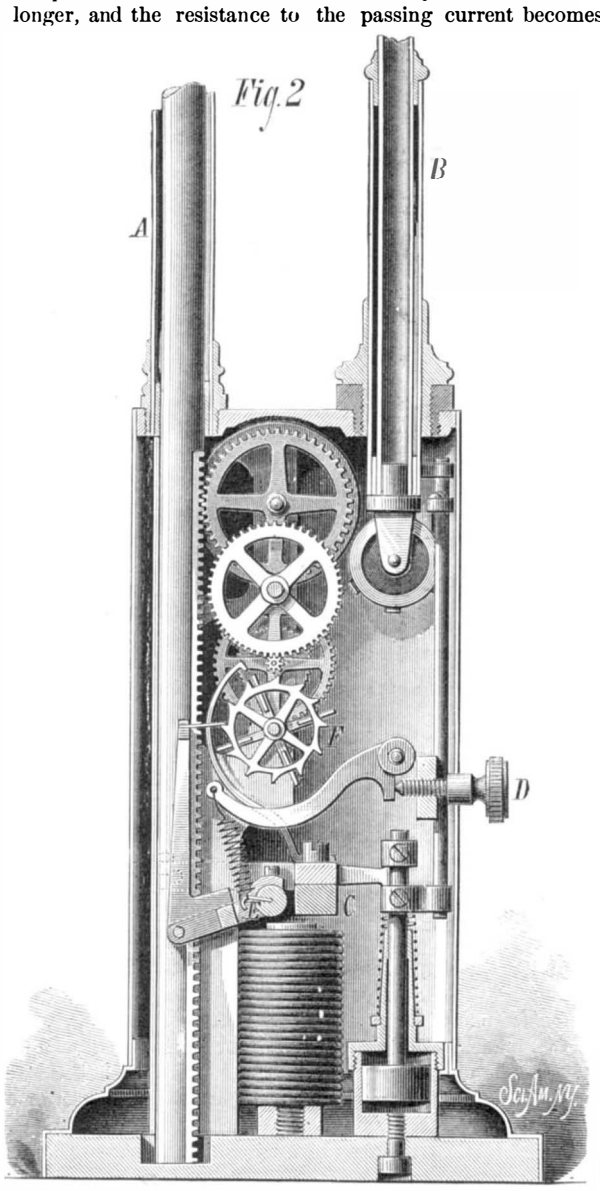
[*Continued from first page.*]

the carbons by this downward movement of the negative establishes the voltaic arc, when the light comes out in all its splendor. As the carbons waste away the arc becomes longer, and the resistance to the passing current becomes

Fig. 2



greater, its power to excite the electro-magnet correspondingly decreasing. The armature, E, is drawn away from the magnet by a retractile spring, the tension of which is adjusted by thumb screw, D. When the magnetism is so much reduced that the pull of the spring is greater than the pull of the magnet, the spring will force the armatures upward and remove the detent from the ratchet wheel, F, thus allowing the train of gears to move so that the carbons slowly approach each other until a point is reached where the arc is shortened sufficiently to again bring the magnet up to its original strength, when it will again pull down the armature and lock the gearing. A too rapid movement of the parts is prevented by a small fan, shown in Fig. 4. When the carbons are drawn apart to a considerable distance and then allowed to approach, this fan will revolve with great speed, and its wings will be spread by centrifugal action to their fullest extent; but when the carbons touch, and the electrical current is established, its speed is much reduced as the larger armature, C, is drawn down, and it remains in that position while the circuit is complete. The armature has an attachment which is brought within the field of the extended wings, but it cannot reach them when they are closed. The fan, when engaged by the attachment, can revolve only a quarter turn at a time and at a very slow speed.

When the ratchet, F, on the fan shaft is unlocked it can revolve rapidly only when the current is broken, and when it is released to feed the carbons to an already established arc it can only turn at a speed a little faster than the actual consumption of the carbons. Should the arc be broken, or the light be extinguished from a high wind or other cause, the large armature, C, will be liberated, and by bringing the lower carbon against the upper carbon it re-establishes the arc instantly. A too rapid movement is prevented by a controlling chamber or dash pot in the bottom of the lamp. All of the comparatively heavy work of separating the carbons and re-establishing the current is done by the armature, C, while the smaller armature, E, has only to lock and unlock the train of gearing.

As the distance to be traveled is very slight, and the work to be done so light, but very little change in the electro-motive force of the current is required to stop or start the feeding of the carbons. The tension of the spring that opposes the magnetism can be adjusted from the outside of the case to balance its pressure against a current of any strength. Where great nicety and steadiness are required, this lamp seems well adapted to meet all requirements. It is small and compact, and appears a very substantial and beautiful piece of mechanism.

Fig. 5 is a side elevation of a less expensive kind of lamp devised by the same inventor. In this lamp both carbon holders are supported by a cord. As the upper or positive holder descends it draws the cord over a pulley and raises the negative just one half the distance traveled by the positive. When the wires are properly connected and the carbons are in position, the top holder may be allowed to run down until the two carbons meet. This establishes the circuit and excites the axial magnet in the bottom of the case, when the core is drawn into the helix, and the two carbons, through the medium of levers, are drawn apart until the magnetism and tension of the spring balance each other, and as the carbon is burned away the arc is lengthened, the magnetism reduced, when the core is drawn out of the spool, thus feeding the carbons together as they are consumed until the parts have reached a position where the ratchet on the lower lever is beyond the reach of the pawl, then the core descends and the ratchet revolves, when the carbons take a new position, and the feeding goes on as before. The ratchet wheel is prevented from turning more than one tooth at a time by a spring at the end of the lower lever. The pull of the rack is opposed to the spring, and when the pull is reduced by the disengagement of a ratchet tooth the lever, and with it the ratchet, are forced downward, and the succeeding tooth is caught on the pawl. The core on which the magnetism operates is connected with the rack by compound levers, so that by changing the position of the connecting link the leverage can be readily adjusted.

Adjustments may also be made with the thumb nut on the top of the case, which is attached to a retractile spring. While this lamp is not so susceptible of a very fine adjustment, still for some purposes it is better than the more expensive one just described. In places where the speed of the dynamo-machine varies much, or where the machine is of poor quality, it is better than the regular clockwork lamp.

The hanging lamp shown in the large engraving has no clock work. It is very simple in design, and is intended as a cheap lamp for common use; it could not be used in a reflector as only one carbon feeds, consequently the focus is continually changing its position.

A new lamp which is quite different from anything before made is shown in Fig. 4. This lamp is in two parts, connected by vertical tubes. The upper portion has a device for feeding the carbons, and the lower portion contains a device for separating them. The focus or source of light is always at the same place, as the two carbons feed exactly in proportion to the rapidity with which they are consumed. This lamp will accommodate itself to widely varying currents. Should a slackening of the speed allow the carbons to come

Fig. 3

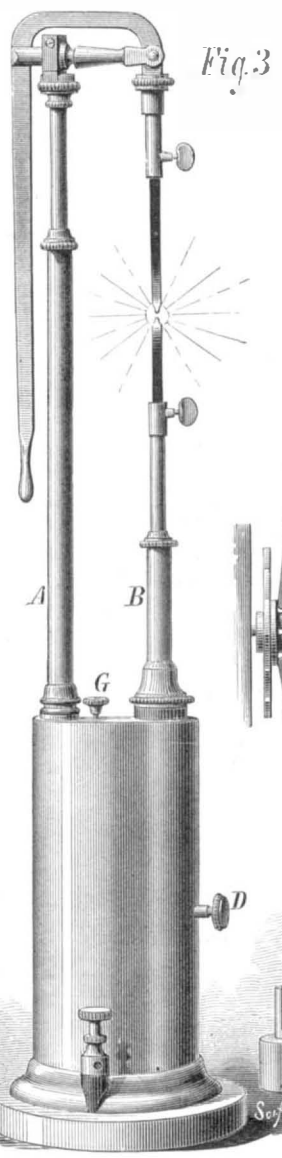
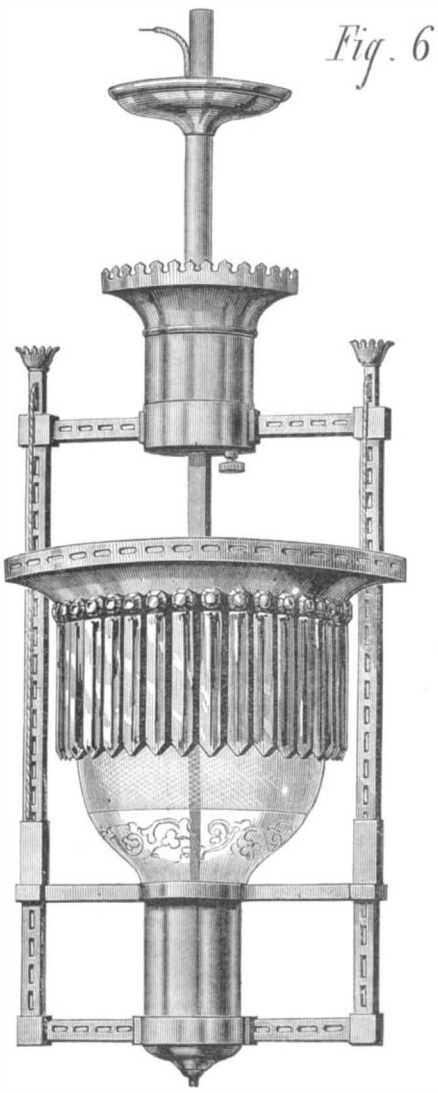


Fig. 4

completely together they would at once draw apart on the increase of speed, and they will do this any number of times in succession. Or the current may be broken and established any number of times without disarrangement of the parts. This feeding has positive movement, and is so nicely balanced that a very slight change in the length of the arc allows the carbons to feed, and should the current be broken, the lower carbon by a very rapid movement re-establishes it before the heat of the carbons is perceptibly diminished, and before the magnetism of the machine is discharged.

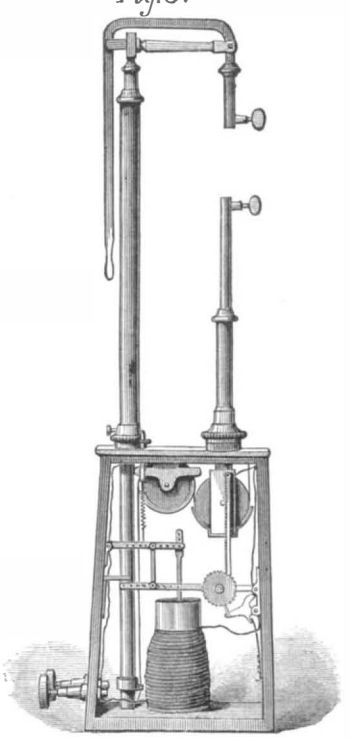
The light from the naked carbon points is dazzling to the eyes, and casts very distinct shadows. The light is of wonderful intensity. To diffuse the light without reducing it very much, and to make the small point appear as large as possible, have been the aim of the inventor in constructing this lamp. Above the focus is a silvered reflector of suitable shape to throw the beams that would be wasted above in a horizontal

Fig. 6.



or downward direction, and from this reflector two rows of prisms are suspended. One half of the prisms are arranged with their flat side to the light, and the other half have their angular side toward the light. Below the focus is a bowl shaped glass, having a zone ground just wide enough to be always between the eye of a near observer and the luminous arc. The point from which the light is emitted appears from a distance diamond shaped and quite large. Thus modified the light can be looked at with perfect ease, while its brilliancy does not seem to be at all impaired, the ground glass portion of the globe only being between the eye and the luminous point. The prisms and glass bowl inclose the light and protect it from the wind. The bowl is suspended by two cords that pass over pulleys and are attached to the reflector. By pulling the bowl downward the reflector is raised up, and thus opening a space through which the carbons may be viewed. A pair of carbons $\frac{3}{8}$ x $\frac{3}{8}$ inch in these lamps last about three hours, and afford a very steady light. Carbons $\frac{5}{16}$ x $1\frac{1}{4}$ inch last about 10 hours.

Fig. 5.



Electric light may be utilized in two ways—either by powerful foci illuminating at great distances, or by less intense foci giving a more diffused light suitable for all kinds of night work, thus including lighthouse service, fortifications, maritime service, shores, armies in action, and for manufactories, show rooms, for open air use, for large workshops, railroad depots and yards, wharf work, steamboats, mines, theaters, large halls, reading rooms, streets, squares, and many other places. For these purposes electric light is superior to all others and much cheaper. Mechanical workshops have been among the first to make use of the electric light, also dyers and sugar refiners, who need a very pure and white light, and spinning mills and foundries have adopted it. Electric light is analogous to sunlight, all colors appearing the same at night as by daylight. Any further information may be obtained from the United States Electric Lighting Company, Room M, Equitable Building, New York city.

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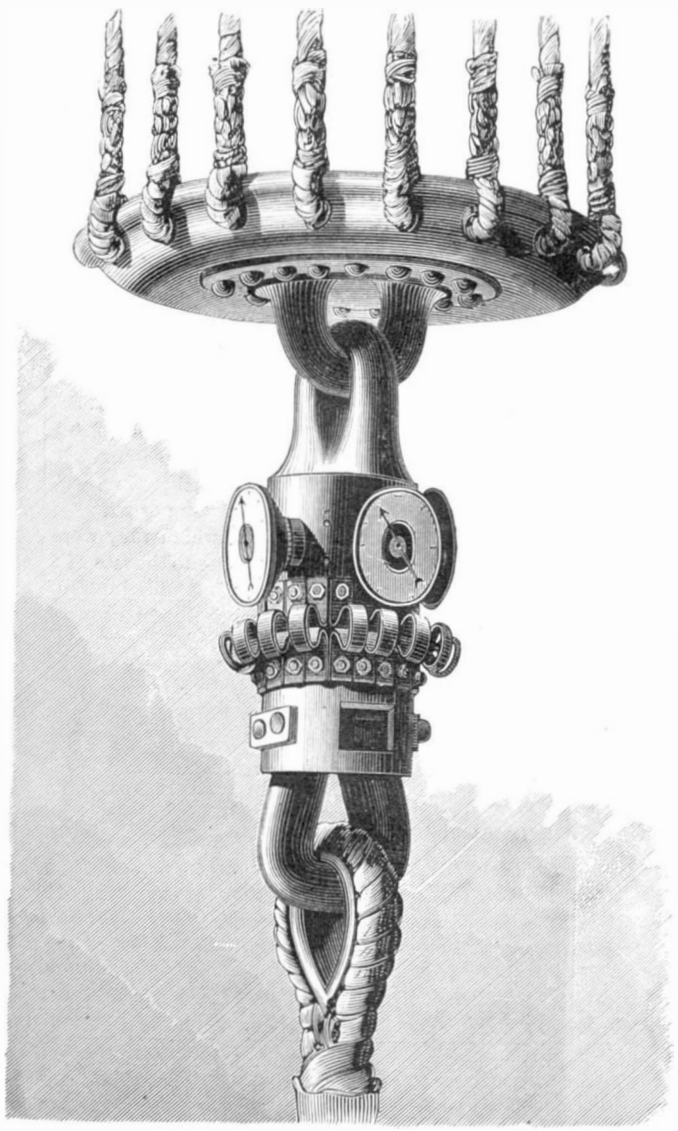
THE DYNAMOMETER OF THE GREAT CAPTIVE BALLOON AT THE PARIS EXHIBITION.

Mr. Henry Giffard's great balloon at the Paris Exhibition possesses many peculiar and interesting points. The general construction of the balloon, its valves, and many of its appurtenances have been described in a former number.

The dynamometer which unites the balloon to the cable is suspended in the center of the space surrounded by the annular gallery of the car. It is formed of two steel cylinders, united by light steel bow springs. Four vertical dials indicate by means of hands the amount of traction in kilogrammes to which the dynamometer is subjected. The aerial voyagers may at any time know the excess of ascensional power of the balloon by inspecting either of the dials.



DYNAMOMETER OF THE CAPTIVE BALLOON AT THE PARIS EXHIBITION.

New Engineering Inventions.

Mr. E. A. Hayes, of New York city, has patented an improved Covering for Steam Boilers. This covering is of felt or other fabric applied to the exterior surfaces of steam boilers and various parts of steam engines for the purpose of protecting them from cold and preventing condensation of steam. The principal object of the invention is to provide means for using the covering again after it has been removed from the boiler.

An improved Turbine Wheel and Gate-operating Mechanism has been patented by Messrs. Uriah S. Sheffer and William H. Sheffer, of York, Pa. This invention consists in constructing the wheel with a conical upper plate, a conical lower plate, and radial partitions forming buckets converging downwardly and toward the center of the wheel, the said partitions being extended downwardly to form curved buckets at the point of discharge. This invention also consists in a novel arrangement of mechanism for operating the gates.

Messrs. Robert Decley and John Turl, of New York city, have patented an improved Portable Railway, which is designed especially for use upon sugar plantations for hauling the cane from the field to the mill. It may be used for various other purposes where a temporary track is required.

An improved Rock Washer for Oil Wells has been patented by Messrs. Frank Jeannerat and Lewis E. Simons, of Edenburg, Pa. The object of this invention is to provide a means of keeping open the apertures in the well tubing through which oil issues for the purpose of washing the rock and preventing the accumulation of paraffine. It consists in a spring carrying a pin, which projects through the aperture in the well tubing, and in a ball or enlargement on the valve rod, which engages the spring and causes the pin to make an outward movement for each stroke of the valve rod.

Messrs. William H. Wilder and Charles W. Conant, of Gardner, Mass., have patented an improved Car Brake, which is so constructed as to enable the brake to be applied with much more force than ordinarily constructed brakes.

Mr. Maximilian Jacker, of Marquette, Mich., has patented an improved Hoisting Machine, which consists in a single differential friction brake, applied to the winding drum, in connection with gearing, in such a manner that the starting, stopping, and reversing of the drum are accomplished by manipulation of the one brake, and this is done without interfering with the operation of any other winding drum which may be operated from the same main shaft.

Mr. John B. Deeds, of Terre Haute, Ind., is the inventor of an improved Machine for Starting or Moving Railroad Cars upon the track. It is so constructed that it may be conveniently operated by a hand lever to move one car apart from another without the necessity of going in between them, and it will allow of a full throw or movement of the hand lever, even while the cars are close together.

Mr. Richard T. Pascall, of New York city, has devised an improved Steam Trap, which consists in a casing containing a spherical corrugated sheet metal float, and having a strainer for preventing the entrance of dirt, and provided with a balanced discharge valve. It has a device for lifting the float independently of the action of the water, and also a guard placed above the float, to carry the water that enters the trap to the side of the casing.

Mr. Louis Leypoldt, of New York city, has patented an improved Railroad Rail for elevated and surface railroads, by which the annoying noise caused by the contact of wheels and rails may be avoided or deadened.

Mr. John J. Tonkin, of Richmond, Va., has patented an improved Gauge Cock for determining the water level in steam boilers. It consists in constructing the axial portion of the cock in such form that it shall fulfill itself the function of a valve by longitudinal movement, so that, in trying the water level, all that is necessary is to grasp the handle of the tube and force it longitudinally in, and then turn the tube axially until its right angular arm dips into the water, the pressure of the steam within serving to force back the tube and seat its valve upon the valve seat.

Experiments with Fog Signals.

Professor Henry Morton, President of the Stevens Institute of Technology, at Hoboken, was appointed by President Hayes, upon the recommendation of Secretary Sherman, to fill the vacancy in the Lighthouse Board, caused by the death of Professor Henry. At the first meeting of the Board after Professor Morton's appointment, he was elected Chairman of the Committee upon Experiments. During the summer the work of the committee was carried on in connection with fog signals, off the coast of Maine. The Professor was accompanied by Admiral Rodgers, General Duane, Commander Picking, Lieutenant Emery, and Commander Walker. The three steamers, Myrtle, Iris, and Daisy were placed at the disposal of the expedition, which had its headquarters at the Lighthouse Station, at Portland.

On his return to this city, Prof. Morton said that the observations proved that a powerful steam fog whistle of the most improved pattern could be heard distinctly ten miles in one direction, and yet might be entirely inaudible at the distance of only a quarter of a mile in another direction. Professor Henry adopted a theory some years ago in reference to certain anomalous sound phenomena, that the wind, when blowing with greater velocity above the surface of the sea than at the surface, in approaching a source of sound, deflected the sound waves so as to throw them upward, and thus make them pass over the heads of observers stationed upon the sea level. Professor Tyndall maintained that the sounds were absorbed by what he termed "acoustic clouds," or spaces of air of greater or less density than the surrounding portions of the atmosphere, which floated between the source of sound and the observers upon the sea level. Several experiments were made by Professor Morton's expedition which proved the truth of Professor Henry's hypothesis. There has been considerable complaint made against the whistling buoys used by the Lighthouse Board, several of which are in use in the New York harbor. Professor Morton stated that the experiments made by his party demonstrated that these buoys are of great practical importance when moored in deep water, as vessels can approach near enough to hear the whistles under all circumstances.

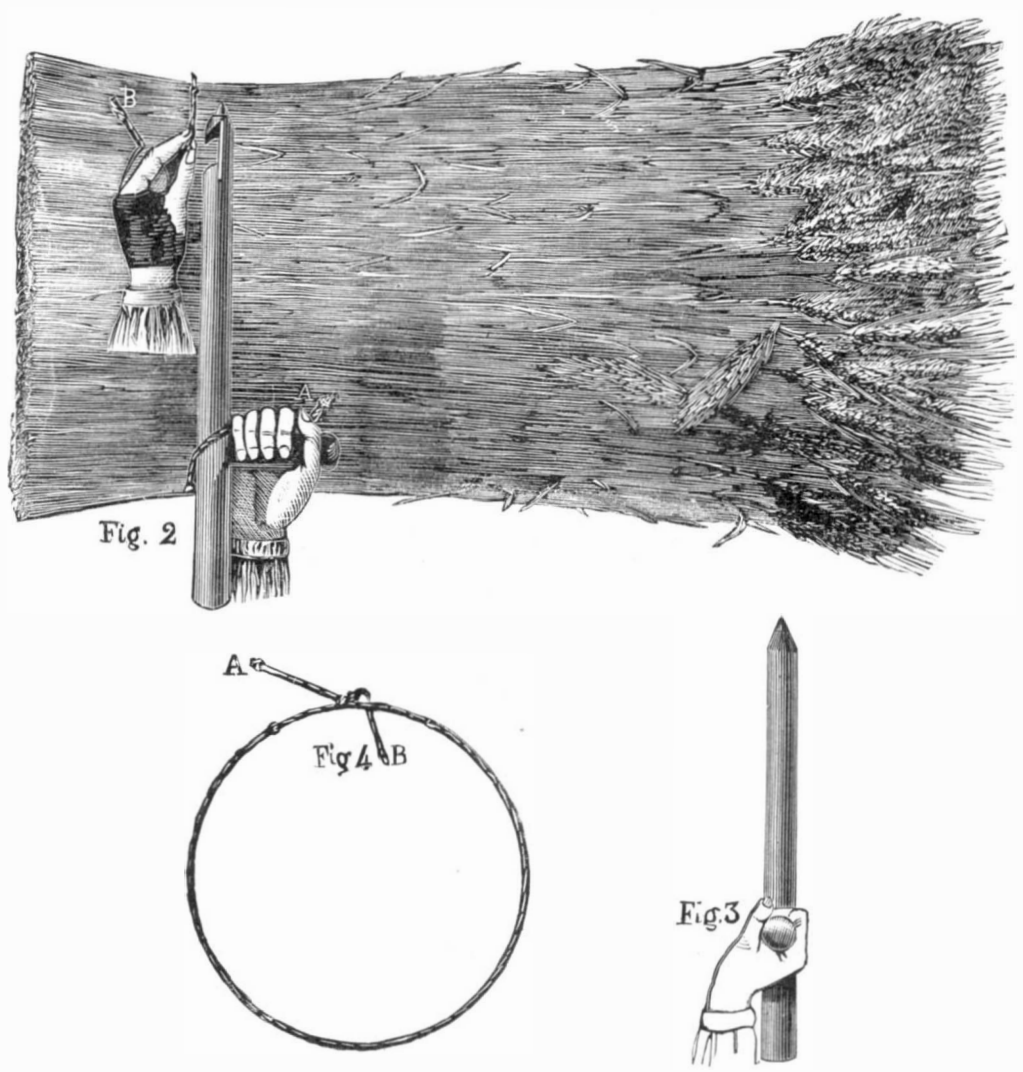
SHEAF BINDING.

The war between wire and twine for the binding of sheaves has fairly commenced. Wire is more convenient, and so far the most successful machines have used it. Wood, McCormick, and Osborne are fairly before the public in the United States, England, and France, with their automatic binders. Johnston's string binder was shown at the Royal Agricultural Society's Show, at Bristol, which has just closed, and one of his machines is at the Exhibition, as are also the others named above as working with wire. While the heavy troops are thus getting into line, there is also a scattering fire among the pickets, and in the French section are various attempts to obviate the use of the bunch of straw taken from the sheaf to form a band. One man proposes to use the bark peeled from osiers, two or three twisted together; these are sold very cheap. Another has cheap hempen strings cut to length and sold in bundles of one thousand each.

It is estimated that the annual crop of France is about 4,000,000,000 sheaves of grain, and that 50 straw bands contain one franc's worth of grain, the whole representing 80,000,000 francs, most of which is lost by shelling out on to the ground or mildewing under the band. Add to this the loss of time in making and applying, and the injury to the grain in the size of the band, which causes dampness to the sheaf. The figures seem formidable, and the *automatique* band is presented to solve the difficulty.

The mode of using it is evident from the engraving on the next page; the wooden block being held in one hand, one knee of the operator is placed upon the sheaf to compress it, while the other hand draws the cord through the ring. The expansion of the sheaf binds the cord between the ring and the block, and makes a perfectly tight fastening. The cord and block are treated with tar, and are smoked to render them indestructible by humidity and noxious to insects, rats, and lizards. The price is 70 francs ($14) per 1,000, 5 feet long.

Another candidate in the same field offers his sheaf bands with



TOULOUSAIN'S SHEAF BINDER.

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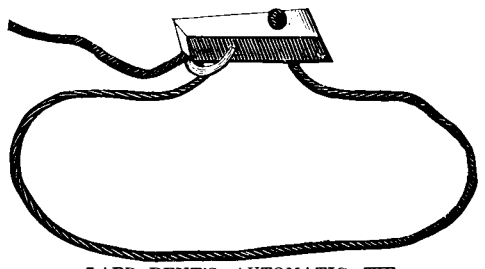
a statement that it saves in the neighborhood of 80 per cent of the labor involved, and more than 200 per cent of the cost of the ordinary bands (*plus de 200% sur le prix*, etc.). It is surely worth examination, for this is actually money in the pocket. The band is composed of two cords knotted together, forming loops. The point of the tool (Fig. 3) is introduced through a loop at or near one end, and is thrust as far as the handle permits. The band being placed around the sheaf, the point of the tool is thrust through such one of



LAPPARENT'S AUTOMATIC TIE.

the other loops as will give the tightness to the band, and the handle end of the tool is then carried over, describing an arc upon the point which is in the sheaf; the loop slips down from the handle to the point end, and the loop caught in the notch is then drawn through the loop on the loop, and the latter is withdrawn, allowing the knot drawn through to catch in the loop, where it is held by the expansion of the sheaf. They are five feet long, and the price is, according to size, from $5.32 to $7.60 per 1,000. *Voilà tout!*

EDWARD H. KNIGHT.

GANG PLOW TRIALS.—PARIS EXHIBITION.

The following report of the dynamometric trials of the best American and French gang plows was received too late for insertion with the detailed account of the competition printed in the SCIENTIFIC AMERICAN last week. Our correspondent observes that no table of equal fullness and value has ever before been published in this country.

Dynamometric Trials of Gang Plows at Petit-Bourg (Seine et Oise), France, August 6th, 1878.

Reported for the SCIENTIFIC AMERICAN, by Dr. Edward H. Knight, U. S. Commissioner, etc.

NAMES OF EXHIBITORS.	TRIALS. (1)	Surface Measure by Planimeter.	Length of trace. (2)	Mean ordinate. (3)	Corresponding effort.	Mean depth of furrow.	Mean width of furrow slice of the gang plow.	Section of land turned.	Power necessary to displace one metric cube of earth. (4)	Mean of two trials.	Length of furrow.	Time of travel.	Weight of Plow.
		Square Millimeters.	Meters.	Millimeters.	Kilogrammeters.	Millimeters	Millimeters	Square meter.	Kilogrammeters.	Kilogrammeters.	Meters.	′ ″	Kilos.
Meixmoron de Dombasle, Nancy (Meurthe et Moselle), France.	1. Going.	115,160	2·430	49·39	497·31	151·4	678·1	0·102664	4814·1	4899·2	160	4 8	247
	2. Return'g.	112,735	2·365	47·67	500·25	161·3	626·0	0·100974	4956·2		160	4 42	
Deere & Company, Moline, Illinois, United States.	1. Going.	120,870	2·512	48·12	504·97	163·0	695·6	0·113383	4453·7	4566·9	160	4 12	260
	2. Return'g.	125,970	2·377	52·995	556·13	167·3	709·0	0·118616	4680·0		160	4 22	

(1) The ground was slightly inclined.
(2) The base line on the paper ribbon of the dynamometer.
(3) Mean distance between the base and profile lines on paper ribbon.
(4) Kilogrammeter, the French dynamic unit. The power required to lift 1 kilogramme to a height of one meter.
One *cheval-vapeur* (horse power) is the power required to lift 75 kilos, a distance of 1 meter (*i. e.* 75 kilogrammeters) in a second.
1 kilogramme=2·2046 pounds avoirdupois.
1 meter=39·37079 inches.

President White on the Paris Exhibition.

In a private letter to a friend in Brooklyn, President White, of Cornell University, speaks of American success at Paris in the following terms:

"The Exhibition is really a vast success from every point of view save the financial. You will be glad to learn that our Americans are carrying off much more than their share of the great awards. Only yesterday, in sitting on the Jury of Appeals, I was greatly interested in seeing how, in one department after another, our people have made their mark. In regard to several exhibits, while the presidents of the class juries presented their reports, they went into exclamations of surprise over the recent revelations of American energy and industry. One of them especially declared that if America went on as she at present is going, in regard to the paper manufacture, she would soon have control of the European markets, instancing more particularly the new applications of this industry in the United States. I only wish we could have had one of those paper boats present, such as that in which our Cornell boys beat Harvard the other day. That would have completed the tableau.

"Perhaps the most striking thing has been the taking of the Great Prize for artistic gold and silver work by Tiffany. Splendid as the Exhibition was in this respect, Tiffany stood above all his rivals. In agricultural implements and in machinery of a certain class we lead everything. But this does not surprise me so much as to find that in various points where we did not expect much there are important recompenses for skill and ability. With all the ingenuity which the French have given to surgical instruments and instruments of precision, I was especially glad to see the United States stand at the side of France in such recognition."

Running the Fast Train.

The train leaving this city at 7:35 in the morning for New York over the Pennsylvania Railroad is among the fastest in the world. Indeed, a portion of the distance is made at a rate scarcely obtained by any other road in Europe or America. The distance between West Philadelphia and Jersey City is 89 miles, accomplished in one hour and 54 minutes, with a single stop, while the return is six minutes less, including two stops. This gives a rate, in going, of nearly 50 miles, and in returning of slightly more than 50 miles an hour, surpassing that of the celebrated Queen's mail between London and Holyhead, where the run of 264 miles occupies seven hours. At half past seven o'clock Friday morning, when a *Times* man, by permission, boarded the engine at the West Philadelphia depot the steam gauge marked 120 pounds and "still rising." Precisely five minutes later the bell clinked over the engineer's head, and almost simultaneously he gave a slight clutch of the lever and the train of four cars was off. It stopped at Germantown Junction 13 minutes later. As soon as the engine got clear of the suburbs she shrieked and bounded away at greater speed. About 20 minutes after it wound its way through Bristol, and in still less time the iron bridge over the Delaware was sighted and Trenton was bisected at the same moderate speed which had been adhered to through Philadelphia. But it was necessary to do better in order to reach Jersey City, nearly 60 miles away, at the appointed time. Trenton was scarcely passed when the engineer touched up his steed. Between the first two mile posts noted, the distance was passed in 63 seconds; the next in a little less, and a third in precisely 60. Hurrah! The train was spinning along at the rate of a mile a minute. And yet everything proceeded with so much smoothness that it was impossible to appreciate the amazing swiftness. There was no unusual jolting, and in the cars the passengers were smoking, dozing or reading, just as though it was an ordinary train in which they were riding. Just beyond Princeton the speed rose to the rate of a mile in 58 seconds and continued it without diminution, except a slight "slowing up" at Monmouth Junction, until New Brunswick was in view. As soon as the town was left behind the engine was at it again, and in the neighborhood of Menlo Park the speed became prodigious, as if the locomotive was snorting defiance to the wonderful Edison in his laboratory under the hill.

In this neighborhood Conductor Silance, with watch in hand, carefully timed the train for three miles. The first was passed in 54 seconds, the second in 52, and the third in 50. The last was 72 miles an hour. The puffs from the engine had become a continuous shuddering roar; the driving wheels were spinning around 400 times a minute—a half dozen times a second—with a centrifugal force that, it would seem, ought to shatter their whizzing peripheries to atoms. The day was a hot one and the air was at a dead calm, but it rushed through the narrow door in front of the engine like a tornado. Small bridges were thundered over so quickly that they gave a single rumble as they whisked out of sight behind; the express train coming from the opposite direction flashed by like a meteor in a single hot puff of air; you might yell to the engineer, two feet distant, and yet he would only see your lips move, without hearing anything above the deafening roar of the engine, which drowns everything excepting the shriek of the whistle. All the time the fireman steadily shovels in coal or climbs around the engine with oil can in hand, his clothing fluttering so fiercely in the wind that it seems in danger of being blown off. The engineer with his hand upon the lever watches, with a catlike vigilance, the rails sweeping under his wheels. The whole train is constantly under his eye, and he never allows his attention to be diverted for an instant.

One Saturday morning, as the train was approaching New Brunswick, and before its speed had diminished, Ed Osmond, the engineer, felt a sudden thump beneath him. It was repeated instantly, and then his entire side of the cab flew off as if from a thunderbolt. But the veteran knew like a flash what was coming when he heard the first thump, and with one bound he threw himself astride the boiler, shut off steam, and applied the automatic air brake. This stopped the train with such suddenness as almost to throw the passengers off their seats; but no one was hurt, and the slight scratch of the engineer's nose and the blow upon his arm did not prevent his running back to Philadelphia in the evening. This is the only accident which the fast train has encountered since it began running on the 8th of July last. As proof of the ease with which the extraordinary speed is maintained, it may be said that the train goes into the Jersey City depot frequently ahead of its schedule time. One day the passengers began stepping off just a minute and a half before the train was due. Of the 29 trips from West Philadelphia to New York, 25 were made on time connection. The train has been missed only twice. Once was on account of the accident mentioned, and the other was a twelve minute detention caused by an excursion train getting in the way. The other delays were just two minutes apiece, occasioned by the draw in the river. The return trip fails oftener, it being difficult to get away from Jersey City at the exact moment, while the run is harder, including more up grade.

The train generally consists of four or five cars, including a palace one, and averages about 300 passengers a day. It is under the charge of Louis Silance, an experienced conductor, while the two engines, which alternately do the work, are run by the veterans Edward Osmond, who has been on the road 21 years and has handled a locomotive 16 years, and Frank Peacock, equally skilled and careful. The register shows that many a mile has been made in 48 seconds, which is at the rate of 75 miles an hour. Going eastward the train makes one and in returning two stops. The driving wheels of the engine are only five feet in diameter, but this will probably be increased to five and a half feet. —*Philadelphia Times.*

The Population of Europe.

Correcting Behm and Wagner's tables of 1878, for the changes just made in Turkey, the population of the several states of Europe is now as follows, the total being in round numbers 312,400,000:

Germany, 1875	42,727,360	Iceland, 1876	71,300
Austro-Hungary, 1876	37,350,000	Spain (without Canaries), 1871	16,526,511
Liechtenstein, 1876	8,664	Andorra	12,000
Switzerland, 1876	2,759,854	Gibraltar, 1873	25,143
Netherlands, 1876	3,865,456	Portugal (with Azores), 1875	4,319,284
Luxembourg, 1875	205,158	Italy, 1876	27,769,475
European Russia, 1872	72,392,770	European Turkey	8,359,000
Finland, 1875	1,912,647	Roumania, 1878	5,149,000
Sweden, 1876	4,429,713	Servia, 1878	1,642,000
Norway, 1875	1,807,555	Montenegro	210,000
Denmark, 1876	1,903,000	Greece, 1878	2,200,000
Belgium, 1876	5,336,185	Malta, 1878	145,000
France, 1876	36,905,788		
Great Britain, 1873	34,242,966		
Faroes, 1876	10,600		

The cession of Bosnia to Austria increases the population of the Austro-Hungarian empire something over 1,000,000. If Turkey is further reduced by the populations of the practically independent principalities of Bulgaria (1,773,000 inhabitants) and Eastern Roumelia (746,000), there will remain to that empire considerably less than five millions, about two and a half millions being Mohammedans.

The Shoe and Leather Trade.

The testimony of actual workingmen before the Congressional Labor Committee is invariably full of interest and encouragement. Markedly of this nature was that of Mr. J. H. Walker, a manufacturer of boots and shoes at Worcester, Mass., and of leather at Chicago—a typical American working man, who has won success by diligence and thrift. He said:

"I employ 497 men, and do a business of about $2,000,000 a year. I began life working at the bench, and have built up my own business, and made all the money I possess. The boot and shoe business is considered next in importance to that of agriculture in the United States. I have before me the statistics of the shipment of cases of boots, shoes, and rubbers from Boston. In 1872 the shipments were 1,452,000 cases; in 1874 there was a decrease of 115,000 cases; in 1875, an increase of 59,000 over 1874; in 1876, an increase of 72,000 over 1875; in 1877, an increase of 237,000 over 1876; in 1878, thus far, a decrease of 156,400 from the same period last year, which is partly owing to the facts that the large sales of rubbers in New York have not been made, and that jobbers are not carrying large stocks, but are buying from time to time. The volume of business has increased since 1874, but there have been small profits, and the business has been carried on rather for the benefit of the workingmen than of the capitalists. Machinery is used in our business, but in a less degree than in the manufacture of cotton and woolen goods. Wages in 1840 were $1 a day for thirteen hours' work; in 1860 they had doubled, and in 1865 were nearly $4; now wages have fallen to about $2, the same as in 1860, with ten hours' work a day. The effect of the introduction of machinery upon the trade has been to improve the shoes, and to increase the working capacity of a laborer about 15 per cent. The effect upon the workmen has been to improve them intellectually. The question to-day is the kind of work and the wages to be paid rather than the want of work. If the people of Massachusetts were driven to it, the soil of that State would amply support its entire population; it has ceased to be an agricultural State because manufacturing has become more profitable than tilling the soil."

Mr. Hewitt—Is there any difficulty in men rising from the rank of employé to that of employer? A. "In 1840 there were in Worcester four firms of shoe manufacturers, consisting of seven persons. Of these only one died in comfortable circumstances. In 1850 there were sixteen firms, consisting of eighteen men; only two of these retired with capital, four have failed, and only two are engaged in the business now. In 1860 there were twenty-one firms, consisting of twenty-nine men; two have gone out of the business with capital, twelve have failed, and only five are now manufacturers. To-day there are twenty-one firms, consisting of forty men; of these only five are the sons of manufacturers, and only one has not been a worker for wages. There never was a time when it was more easy for a journey-

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man to rise to the rank of manufacturer than now; a workman of established character and known ability has no difficulty in obtaining credit. The failures have been caused chiefly by investing money outside the business, and then drawing money out of the business to protect the investments. Two thirds of the workmen I have known have saved money, and a large proportion of those living in the country own their houses and some land. A larger proportion of the workingmen than of the manufacturers, since 1840, have ended their days in or are now living in competence. I have never known an industrious temperate workman, except in the case of some calamity like sickness, who was not in comfortable circumstances."

"I venture to say," Mr. Walker continued further on, "that in one year there will be very few willing to work and unable to do so. I think there are not so many men looking for work in this August, 1878, as in any August from 1840 to 1850.

[The Textile Manufacturer.]

Marvelous Inventions in America.

SIR: "John Bull" will, no doubt, be pleased to learn that there is supposed to be in existence a far greater invention than the Clements card attachment. I will, therefore, endeavor to give him a short history of this wonderful machine.

Some two or three years ago there was down in the State of Connecticut an antiquated specimen of a Dutch American, who had been hard at work for some time on this to be wonderful contrivance. No one seemed to divine its object, but finally a Yankee, more curious than the rest, accosted the inventor one day in this wise: "I say, friend, that is a mighty kind of a curious machine you are building up. I guess and calculate from its appearance it must be destined to produce wonderful things. Now, friend, just tell me what it is for?" The directness of the question caused the inventor to put down his hammer and chisel. He lifted his spectacles on to his forehead, and looking at the inquiring Yankee for a few moments replied, "Ha! yes, sir, this is to be one mighty machine. I have no time to tell you all it is designed for, but among other things it is intended for the production of sausages and scrubbing brushes." The inventor then pointed out two set screws and a peculiar hopper, explaining that by the combination of that peculiar hopper and the two set screws, sausages or scrubbing brushes could be produced at will by simply driving live pigs into the hopper, its capacity being only limited by the number of pigs operated upon.

Now, it is just possible that this machine, besides sausages and scrubbing brushes, is intended to produce checks, ginghams, etc., by feeding cotton seed; all wools thoroughly shrunk by feeding turnips and grass; silks and satins of every description by feeding silkworms, caterpillars, or mulberry leaves; and finally to produce power to turn itself, the bottled sunshine in coal will not be required; but merely a casual glance from the glorious sun which rules our system.

If all the above should be realized the pride of "John Bull" at the smartness of his American brother will be great indeed; but pride leaves little cash, and riding on a horse's tail is not very edifying.

Now, sir, I have had long experience on both sides of the Atlantic, and have concluded there is just as much smartness in the English workman as there is in the States; for are not English workmen sought after in America in preference to other nationalities? Why? Because he is generally a thoroughly good workman.

My impression is that in England the artisan is treated too much like a machine. Hence, England, with her vast wealth and ingenuity, begins to feel and fear outside competition. To win you must run. The British Isles ought to be the very hotbed of fostered ingenuity. It is all very well to provide free libraries, comfortable coffee houses, etc., for the artisan, but man is but man, in whatever stage we find him; he loves money, and if you desire to hold the lead in the race that is being run between nations, you must offer something more than libraries, coffee houses, etc., to your toiling artisan. Nothing is more conducive to fallow the intellect than working without stimulation. What makes Americans, native or adopted, so full of restless ingenuity, and constantly on the look out for improvement? It is an efficient patent law—a law made to meet the position of the artisan.

The English artisan has ceased to compete in a race in which he can only win weekly wages. The sooner he is given a title to his birthright (the production of his brain) the better. Where is the justice of a cheap and long term of copyright to a party who can write fiction, very often trash, while the artisan, to secure his ideas, is taxed by an unjust and expensive patent law? The law as it stands I consider the cankerworm of British industries. Nine tenths of inventors spring from the practical workingmen; if so, why not make the patent law simple and cheap? Is it the true policy for a manufacturing nation like Great Britain to tax her toiling sons to such an extent that there is an accumulated surplus fund of £1,250,000 credited to the Patent Office Department? What do those figures mean? So much paid over and above the working expenses of that department. It seems to me simply preposterous for any Government to derive a revenue from a tax upon the inventive genius of the people.

England has held her position by the genius of such men as Watt, Crompton, and Westwood. Yes, and other nations see it. Therefore America extends the utmost facilities to her inventors to secure their rights. Certainly this facility has caused numberless useless patents to be taken out; but what of that if it has fostered good ones?

Can "John Bull" wonder if a workman who earns, say, 32s. a week, should keep his ideas to himself? I say, give your artisans the same chance as they get in America, and you will find them holding their own. Yes! even in the production of card machine attachments, Dutch-American sausage and scrubbing brush machines, or for anything else.

I am, sir, yours truly, BROTHER JONATHAN.

Manchester, June, 1878.

A NEW CAMERA LUCIDA.

The various kinds of camera lucida hitherto used have always possessed many inconveniences, none of them allowing to be seen upon the paper with sufficient precision, and simultaneously, the image of the object and the point of the pencil. For the purpose of remedying this inconvenience, Dr. J. G. Hofmann, of the Rue Bertrand, Paris, has had recourse to an arrangement by which he believes he has obtained the most satisfactory results. The illustration, which we take from *Nature*, will give some idea of this arrangement.

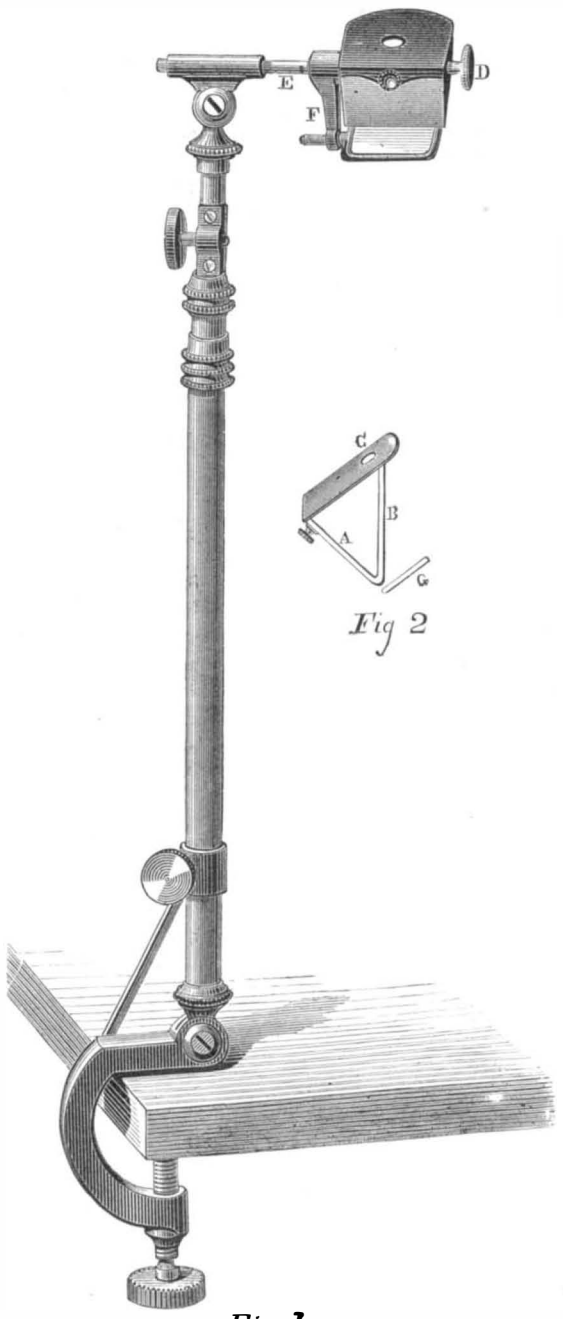

Fig 2

Fig. 1

Fig. 1 represents the general elevation, in half size, of Hofmann's camera lucida. Fig. 2 is a transverse section of the optical part, composed, at A, of a metallized mirror, or other metallic surface, polished and rigorously plane; at B, of a small plane mirror of parallel glass, forming, with the metallized mirror, a fixed angle. The function of the latter is to let pass a part of the luminous rays coming from the object to be drawn, and to show at the same time the point of the pencil alongside the image upon the paper. At G may be placed, in a movable frame, either a plate with parallel surfaces, or lenses of neutral glass of various foci, the principal object of which is to enable a satisfactory drawing to be made of the objects placed inside, when using white paper; for the outside, this glass serves to temper the brightness of the sun.

At C is the eye-hole or opening before which the eye is placed. The knob, D, serves to place the chamber in a convenient position, which sometimes depends on that of the artist with respect to the object, but generally it is convenient to place the mirror, D, vertically. With the same pieces of the optical part, with the addition of a concentrating lens, Dr. Hofmann has been able to construct a second model applicable to microscopes, for which, as well as for telescopes, all previous forms of camera have given only very mediocre results.

NOTES OF PATENT LAW.

DECISIONS OF THE COURTS.

In Herring *vs.* Gas Consumers' Association, the complainant alleged that he was the owner of an undivided two-thirds interest in the patent described, and that the defendant was the owner of the other undivided one-third interest; that the defendant was using a device which was an infringement upon their common patent, and that he was so doing under cover of their common patent. The complainant claimed damages for said infringement; not for the entire amount, but for his proportion, to wit, two thirds.

The defendant demurred to the bill of complaint, on the ground that, being a joint owner of the patent, he could not be treated as an infringer. The direct question thus presented was whether an infringer of a patent could escape liability for his infringement on account of being a joint owner of the original patent so infringed. Now it is evident that if a stranger was guilty of the infringement he could be compelled to respond in damages; but could a part owner infringe the common patent and escape all liability? If so, then, however small his aliquot part, he could make the enjoyment of the patent valueless to his joint owners. He has, by virtue of the joint ownership, a right to use the patent, but he has no right more than a stranger to infringe the same.

The court, therefore, looking at the question from this standpoint, overrules the demurrer, holding that the infringer could not escape the consequences of his own wrong to the other joint owners of the patent, by averring that he was by his infringement injuring not the other joint owners alone, but himself also. In other words, he could not, under cover of his interest in the common patent, shield every wrong doer who might infringe the patent. He would, by so infringing, become liable to the other part owners for the wrong done, and the amount of the recovery would be proportionate to their respective interests.

TRADE MARK CASES.—DECISIONS OF THE PATENT OFFICE.

The Commissioner of Patents has affirmed the action of the Examiner of Trade Marks in refusing to Rader & Co. the registration of a trade mark for drain and water pipes, consisting of the word symbol "iron stone" in connection with an oval figure. No trade mark for the words "iron stone" could be granted, as it has been repeatedly decided that a generic name, or a name simply descriptive of an article of trade, of its qualities, ingredients, or characteristics, could not be entitled to protection as a trade mark. But the question in the present case was, whether such words, when associated with the oval figure exhibited by the applicants, would constitute a registrable trade mark. Simple circles, ellipses, scrolls, borders, and the like, marked in plain outline, are commonly employed in business as inclosures for trade or descriptive names, and for terms designating quality, place of manufacture, and other information appropriate to particular classes of goods. The outline figure in such case serves more to direct the eye to the lettering or symbols they inclose than to suggest of themselves or by association any idea of individual origin or ownership. While it is true that plain outlines, such as the lozenge figure, etc., have been registered, yet such registration has only occurred in those cases where the characters inclosed were proper trade marks of themselves. The applicants not being able to bring themselves under such cases, their application was refused, the Commissioner holding that a proposed trade mark in which words descriptive of quality, characteristics, etc., were inclosed in a simple outline border—as was the case with the application under consideration—was not sufficiently distinctive from the descriptive words used alone to entitle the mark to registration.

An Economical Locomotive.

A new anthracite coal burning locomotive has lately been tried on the Old Colony (Mass.) Railway with very promising results. It is said that it is constructed with a largely increased fire surface in order to remove the difficulties arising from the consumption of coal in the ordinary locomotive. Rating the consumption of fuel in the ordinary locomotive at forty to fifty pounds per hour per square foot of grate surface, in this engine when doing its hardest work the consumption is said to be only sixteen pounds per hour. The fire box is behind and on a line with, instead of under, the boiler, and while in the common locomotive the dimensions are 60 and 66 by 32 inches, the new design is 8 feet 6 inches long by 7 feet 6½ inches wide. The heating surface of the fire box is 103 square feet; of the combustion chamber, 26 feet. The grate rest is between water bars, which prevent them from burning out, and the area is 64 feet. The diameter of the six driving wheels is 54 inches, and above them are placed the boiler and fire box. The cab is over the rear end of the boiler, while on top of the fire box are seats, protected from the sun by an awning. The weight of the engine is 86,150. At the front end of the boiler is a revolving register, which, when open, has an area of six hundred square inches. On account of the free steaming qualities of the engine, it becomes necessary to open this register in order that the steam may pass directly to the stack without passing through the fire. The fuel used by this engine can be delivered in Boston at $2.25 per ton, or $1.50 less than the cost of fuel which is now used. As the fuel remains perfectly quiet in the fire box, the consumption is slow, and although the engine has no spark arrester, not a spark escapes from the stack; neither is there any annoyance from smoke and gas, which are consumed.

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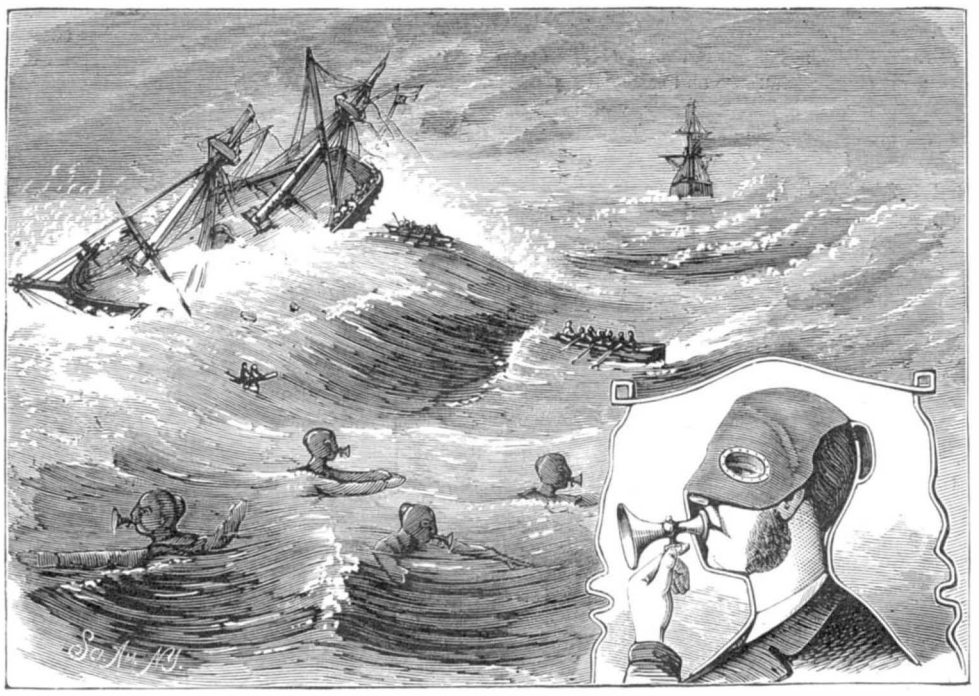
A NEW HEAD PROTECTOR.

In view of the great amount of travel upon both land and water, and of the dangers accompanying the present means of locomotion, it is a source of wonder to us that inventors have not given greater attention to the matter of life saving apparatus. The accompanying engraving represents a recently patented life saving device, to be applied to the heads of shipwrecked persons, or to persons exposed to the smoke and heat of a fire. It consists of a rubber helmet that closes tightly at the neck, but fits loosely on the head, and has at the upper part a device for ventilation. The helmet is made of a single continuous piece of rubber or of several pieces cemented together. The lower part of the helmet is made narrow so as to fit tightly around the neck and over the shoulders.

The ventilating device at the back of the head near the top of the apparatus consists of two layers of rubber, the inner layer being perforated at the bottom and the outer layer at the top, so that any water that might enter the air space will naturally run out without entering the interior of the helmet. There are eye apertures at the front of the helmet which are closed by glass eye pieces, and the helmet has a mouth piece which is provided with a stop cock for excluding water. The mouth piece is used in case it is necessary for the wearer to communicate with his companions. The device may be used as a protection against rain, sleet, snow, and spray, while on the deck of a vessel in storms; or it may be used when made of suitable material by firemen; or when it is made of lighter material it may be used by ladies as a bathing cap. This invention is represented in detail in the smaller engraving, and in actual use in the larger engraving.



CUMMERFORD'S HEAD PROTECTOR.

Further particulars may be obtained by addressing Mr. Francis P. Cummerford, 609 North 7th st., Wilmington, Del.

THE POLYSCOPE.

M. Trouvé has recently presented to the Physical Society of France a new apparatus—the polyscope—designed for lighting up cavities in the human body, the interior of mines, powder mills, deep waters, etc. This device is based on the property possessed by a voltaic current of giving out heat in a short circuit, and the law of which Joule has given as follows: The quantity of heat given out in a unit of time, in a metallic wire traversed by a voltaic current, is proportional—1st, to the resistance that the wire opposes to the passage of the electricity; 2d, to the square of the intensity of the current.

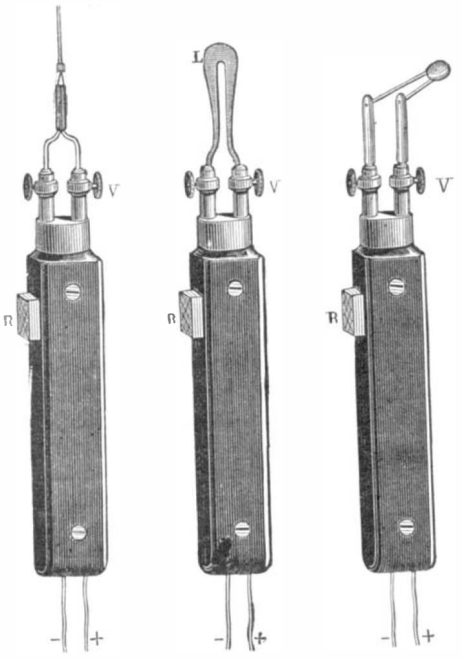


Fig. 2. CAUTER. Fig. 3. CAUTER. Fig. 4. MOUTH REFLECTOR.

This property of the voltaic current of making metallic resistant conductors red hot in traversing them was made use of in surgery by John Marschall about 1851; by Leroy d'Etoiles, in 1853; by Mideldorpf, in 1854; by Broca, in 1856, etc. The production of illumination was not tried till later.

In 1867 Dr. Bruck, a dentist of Breslau, brought out an apparatus called the "Stomatoscope," designed for lighting up the mouth cavities. A little later still, in France, Dr. Millot made numerous experiments in lighting up the stomachs of animals at the Ecole Pratique of Paris. These trials were not followed by success, owing to the inconstancy of the electric source (Bunsen and Grove couples), which necessitated at that time the use of thick platinum wires to prevent constant volatilization. Many luminous effects were obtained, but the calorific effects which accompanied them were too intense to allow any practical application of the method. Recourse was then had to a circulation of water to destroy the heat as fast as produced, but this made the apparatus too bulky, and it became also difficult of management, and was consequently abandoned.

M. Trouvé, convinced of the practical importance of such a system of lighting, has given himself up since 1870 to indefatigable studies in this direction. That his experiments have been crowned with complete success is due, he asserts, to the judicious selection and use of the secondary pile of M. Gaston Planté.

The illuminating apparatus, or polyscope, of M. Trouvé is composed of a reservoir, A (Fig. 1), storing up dynamic electricity, or, in other words, secondary pile of Planté. By means of a special rheostat, AC, of great simplicity, in conjunction with a galvanometer, B, of two circuits, in which the electro-motive force of the reservoir and that of the Trouvé-Callaud pile designed for charging it are in opposition, M. Trouvé is able to regulate the flow of the stored-up electricity at will. By the ingenious combination of these devices the practitioner can always regulate, according to his pleasure, the flow of the fluid, and always know by means of the galvanometer how much of a charge there is in the secondary pile. We use the word "flow" because those who are acquainted with the secondary pile know that it may be likened to a hydrostatic reservoir. The rheostat in the secondary pile is analogous to the stop-cock in the latter, both serving to modify the outflow of fluids.

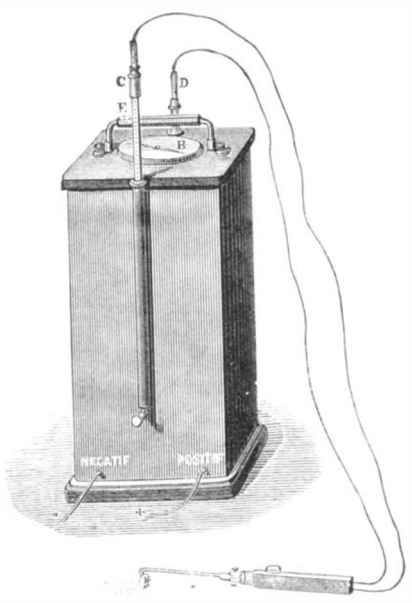


Fig. 1.—THE POLYSCOPE.

M. Trouvé's apparatus is so regular in its action that it allows a platinum wire from 1·15 to 1½ millimeter in diameter to be brought up to the point of fusion and kept there for several consecutive hours without ever going beyond it. This is readily conceived, however, when we reflect on the constancy of the electro-motive force of the secondary pile and the minute degree to which the regulator is graduated. The point of fusion of the wires determined once for all, further trouble is ever after avoided.

The platinum wires, instead of being spirally bent, as is usually the case, are here simply flattened in the middle, so as to form a small incandescent disk. This device gives an illuminating power fully double that by the spiral method—a statement which has been confirmed by Captain Manceron in his experiments in lighting the interior of cannons at Saint-Thomas d'Aquin. By means of the polyscope this distinguished officer has been enabled not only to illuminate the interior of cannons and howitzers, but also to throw on a screen the minutest defects found in any piece of ordnance.

The polyscope is provided with a series of concavo-spherical or parabolic reflectors (Figs. 5, 6, 7,) with or without mirrors, for giving certain effects of light. A handle and conductors connect these reflectors with the reservoir at C and D (Fig. 1). Figs. 2 and 3 represent cauters for physicians. Fig. 4 is a mouth reflector for the use of dentists.

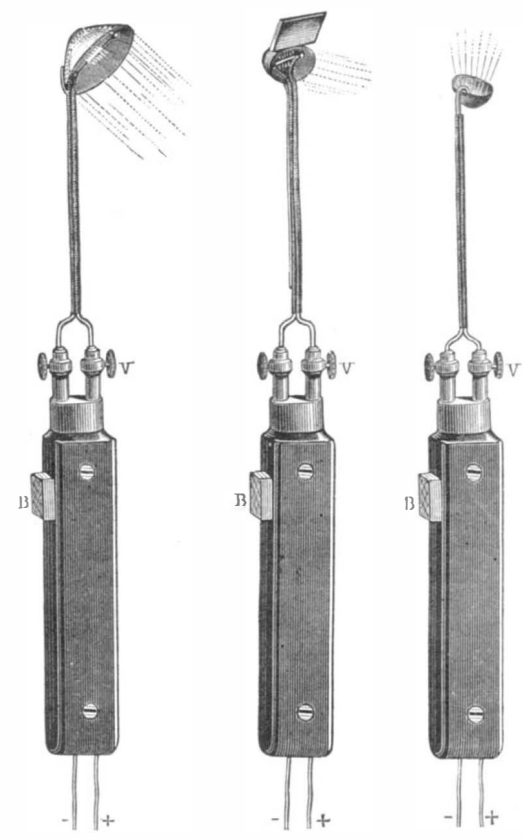
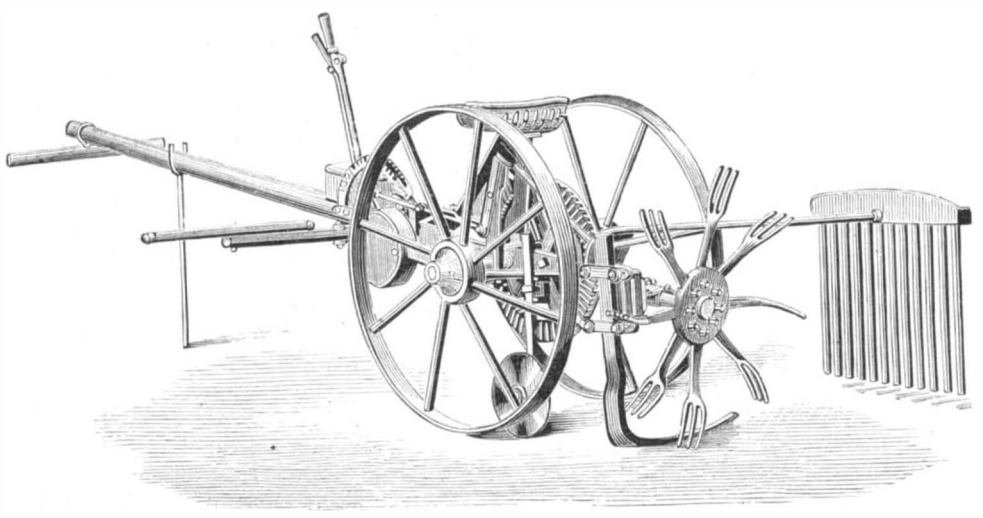


Fig. 5. Fig. 6. Fig. 7.
VARIOUS FORMS OF REFLECTORS.

POTATO DIGGER.

The great importance attached to the successful cultivation of the potato has led agricultural engineers to pay much attention to the manufacture of machines required for cheapening and improving the successive manipulations of this root. The implement which we illustrate this week was invented by Mr. Winton, and is being manufactured by Messrs. Penney & Co., of Lincoln. As will be seen from the engraving, which we take from *Iron*, the machine is drawn by a couple of horses, and is carried (together with the driver) on a pair of large wheels, which take the weight of the whole of the gear, and by their rotation impart the required motion to it. The loosening of the ground is effected by a powerful and broad knife, bent to the required shape so as to pass completely beneath and partly lift up even the deepest roots,



WINTON'S POTATO DIGGER.

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Behind the knife is a wheel with eight prong-shaped arms, which is revolved by a simple bevel gear, the "pinion" being secured to the same shaft as the eight-pronged wheel, and the bevel "wheel" being mounted on the main axle and driven from the road wheels. A small thin wheel or disk in front of the large knife, as clearly shown, assists in dividing the ground vertically and thereby lessens the work on the knife. The prongs of the revolving wheel cut off the tops and strew the potatoes on the ground ready for collection and bagging, a screen suspended from the main framing preventing them from being thrown too far, and separating them from the loosened mould. By a lever within easy reach of the driver, the knife, disk, and the prongs can be raised clear of the ground for traveling, or adjusted to any required depth to suit the crop under operation. By a suitable clutch the bevel wheels can be thrown out of gear with the road wheels, and the prongs thereby prevented from revolving. The machine is highly ingenious, and, although it has been before the public less than two years, has already been widely applied, and has met with general approval. It is capable of digging three to four acres of tubers per diem.

Evaporation of Saline Water.

A correspondent suggests the following method of evaporating saline water: Let the water be forced upward to a great height into a highly heated apartment, through numerous pipes whose mouthpieces shall reduce it to the finest possible spray. Much of the water will in this process be immediately evaporated, and may pass upward out of the roof of the building. Let the spray fall on to an inclined plane, to flow out into a reservoir, whence it may be again ejected through nozzles with coarser openings, again to fall; and let this process be repeated until the water becomes so much filled with solid particles of salt that it can no more be sent upward to fall in the form of spray. The operation of evaporating the water in the usual way after such a course of treatment might be comparatively simple and inexpensive.

Coming Prosperity.

The work of the Custom House Investigating Committee in connection with the various industries of the country has led its chairman, the Hon. Fernando Wood, to the opinion that the United States are "on the eve of the greatest prosperity the American people have seen, from the Revolution down. It will not be fictitious, and based on the stimulant of champagne and speculation, as after the war, but on the strength of our native constitution and enforced sobriety. The reaction in 1873 gave us a terrible headache, for we had been running riot and were intoxicated. Those who survived feel to-day better and stronger than ever before. We have been taught a good lesson in enforced economy, and the precept of economy is now practiced by even our millionaires. It permeates the whole social fabric."

GATHERING THE SAP OF THE MAGUEY.

The *Agave Americana*, American aloe, is called the *maguey* in South America. It has a short cylindrical stem terminating in a circular cluster of hard, fleshy, spiny, sharp pointed, bluish green leaves, each of which lives for many years, so that but few have withered away when the plant has arrived at its maturity. It is a popular error that this only occurs at the expiration of a hundred years, when the tree flowers, and again lies dormant, so far as its efflorescence is concerned, for another century. The American aloe varies in the period of its coming to maturity, according to the region in which it grows, from 10 to 70 years. So soon as it matures, it sends forth a stem 40 feet in height, which puts out numerous branches, forming a symmetrical cone. Each branch bears a cluster of greenish yellow flowers, which continue in perfect bloom for several months.

The American aloe is applied to many uses. From its sap, drawn from incisions in its stem, is made *pulque*, a fermented liquor highly esteemed by the natives of the countries in which the plant is indigenous. Our engraving represents a native in the act of gathering the sap. A coarse sort of thread is made from the fibers of the leaves, known as pita flax. The dried flower stems constitute a thatch which is perfectly impervious to the heaviest rain. From an extract of the leaves balls are made which can be made to lather with water like soap; and from the center of the stem split longitudinally a substance is obtained for a hone or razor strop, which, owing to the particles of silica which form one of its constituents, has the property of speedily bringing steel to a fine edge.

Americans in Turkey.

In his speech at the grand dinner given to the British plenipotentiaries in the London Mansion House, on their return from Berlin, the Earl of Beaconsfield referred to the American missionaries in Turkey as a body of men "of the highest principle, of even a sublime character—men who devoted their lives for the benefit of their fellow creatures, and sought no reward but the convictions of their own consciences." And their report with regard to the social and educational improvements that had taken place in Turkey since the Treaty of Paris was relied upon by the Earl as of more value than the dispatches of either Russian or English consuls.

THE TUFTED COQUETTE.

This rare and beautiful humming bird seems to be entirely a continental bird, not being found in any of the West Indian Islands, and its principal residence seems to be in Northern Brazil and along the banks of the Amazon as far as Peru. It may be readily known from the other species of coquettes by the colors of its head, crest, and neck plumes. The crest and top of the head are a rich ruddy chestnut,

THE TUFTED COQUETTE.

and the upper surface of the body is bronze green, excepting the wings, which are purple black, and a broad band of white which crosses the lower part of the back. From the white band to the insertion of the tail is bright chestnut. The tail is also chestnut, except the two central feathers, which are green at the latter half of their length. The forehead and throat are emerald green, and the neck plumes are snowy white tipped with resplendent metallic green.

The female has no crest nor neck plumes, and the band of white across the back is very narrow. The total length of the bird is about 2½ inches.

We take our engraving from Wood's "Natural History."

New Mechanical Inventions.

Mr. William J. Henderson, of Valdosta, Ga., has patented an improved Machine for Transmitting Motion from a Driving-power to Mortars and other implements.

An improved Automatic Wagon Brake has been patented by Mr. Stephen S. Miller, of Claverack, N. Y. The object of this invention is to furnish an improved brake for attachment to wagons, which shall be so constructed as to be applied to the wheels by the forward movement of the wagon against the horses in going down an incline.

An improvement in Work Supports for Metal Turning Lathes has been patented by Mr. Hans Reiss, of Jersey City, N. J. The object of this invention is to furnish an improved bushing for screw and pin machines, for holding the stock against the pressure of the tool. It is so constructed as to hold stock of different sizes, and is simple, convenient, and effective.

Mr. Patrick H. Childress, of Waynesboro, Va., has patented an improvement in Millstone Drivers which consists in arranging about the spindle, and between the spindle and the forks of the jointed driver, a ring or collar, which affords a bearing for the inner ends or forks of the driver sections, and, by allowing said inner ends to swivel about it, secures an equal and more direct movement between the sections of the driver, obviates lost motion, and yet does not require the forks to touch the spindle.

Mr. Lowry B. Rowland, of Monmouth, Oregon, has devised an improved Horse-power Equalizer for applying the draught to the machine in such a way that the draught may be equalized among the teams. It will enable a weaker team to be favored, and will enable a team to have a solid pull when necessary. It will also hold the master wheel in a perfect level.

An improvement in Chain Links for Horse Powers has been patented by Edward A. Smith, of St. Albans, Vt. This invention consists in a novel construction and form of a cast metal rack or bar provided with gear teeth, and a steel trap provided with bearings for pivots or bolts; and also in a novel mode or process of attaching and combining said bar and strap to form a link, whereby simplicity and economy of construction are obtained, and a strong, durable, and reliable link is produced.

An improved Sewing Machine has been patented by Mr. Daniel Williamson, of Sunbury, Pa. This invention has reference to such improvements in sewing machines that a new and improved motion for the shuttle driver, and also a simple cam motion for operating the presser foot, feed bar, and needle bar, are obtained.

Mr. John S. Gifford, of Fairfield, Me., has patented an improved Axle Nut Wrench, which may be used to take off the nut from a wagon or carriage axle, to allow of the removal of the wheel, and to screw the nut on again, without any necessity of handling the nut, thereby avoiding the danger of getting sand in the bearing of the wheel or grease upon the hands of the person using the wrench.

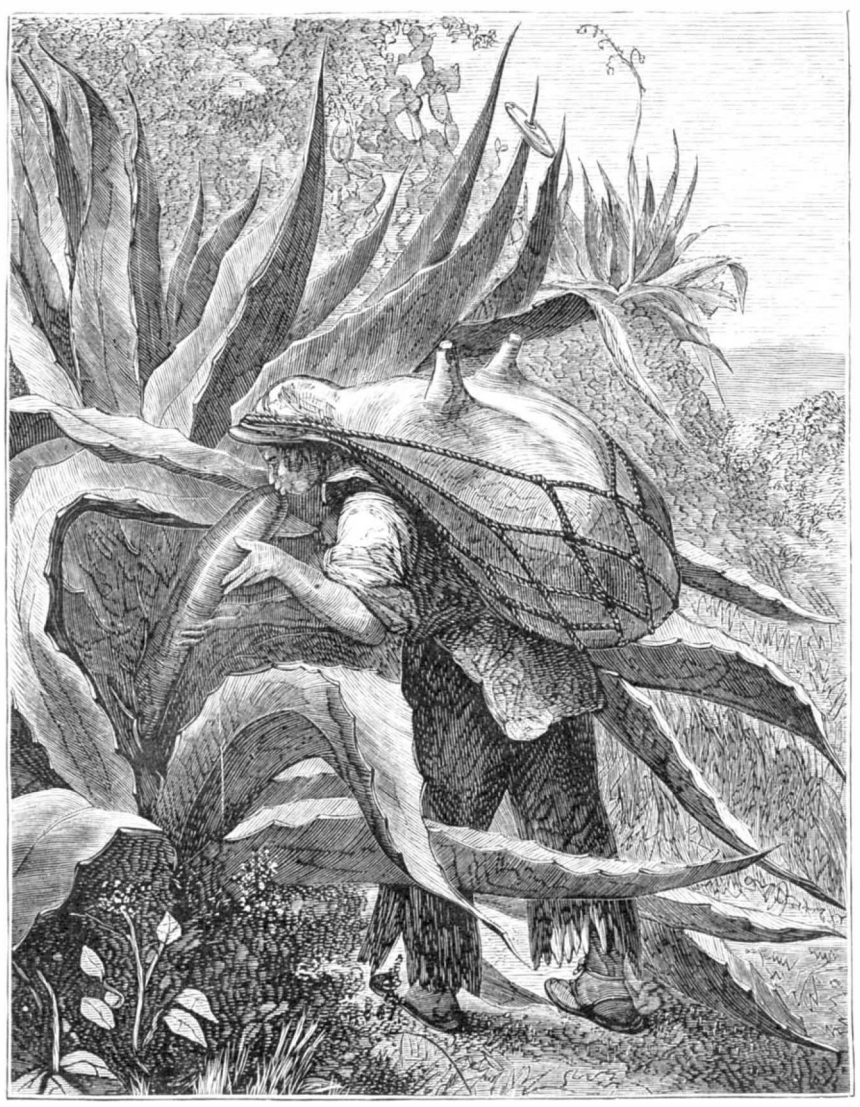
Mr. David H. Hatlee, of Clifton Park, N. Y., has patented an improved Machine for Making Horseshoes. This machine has a horizontal bed, of which a portion is movable and carries dies, around which the shoe is formed (from a bar of suitable length) by means of devices attached to the fixed portion of the bed or frame of the machine, all of said devices being connected with and operated by the movable part of the bed.

Mr. William F. Lane, of Elgin, Ill., has devised an improved Treadle Movement, whereby the power is applied continuously and evenly in one direction only, without springs and the loss of motion and power necessary to pass dead centers, and by which the operator can control the machine by his feet alone, thus having his hands free to hold or adjust the work.

Messrs. Charles H. Holdredge, of Westerly, R. I., and Charles H. Cowan, of Stonington, Conn., have patented an improved Thill Coupling for connecting the shaft iron of a carriage with the axletree clips, so that they will be firmly connected and wear may be compensated for. It has screw sockets in the clips or ears, forming supports or bearings for a pivot pin connected with the shaft iron. The screw sockets may be adjusted to compensate for wear, and are kept from getting loose by jam nuts. The pivot pin is connected to the shaft iron by a set screw, so that the pin and the shaft iron shall move together.

Mr. John Thorpe, of Fort Miller, N. Y., is the inventor of an improved Rotary Boiler for boiling and steaming paper stock, which consists in a boiler mounted on axles in suitable bearings, and having a steam supply pipe passing through the center of one or both of the axles and into the end of the boiler. Two distributing steam pipes pass from the end of the supply steam pipe and extend lengthwise of the boiler, near its sides, so that as the boiler turns the distributing pipes turn with it, and one or the other of them is in the material at all times.

Messrs. William F. Rosser and Julius L. Briggs, of Marshfield, Mo., have devised a cheap and simple Attachment to Hand Printing Presses for guiding, catching, and holding the frisket when the latter is being raised from the tympan for adjusting the paper, or for any other purpose.



GATHERING THE SAP OF THE MAGUEY.

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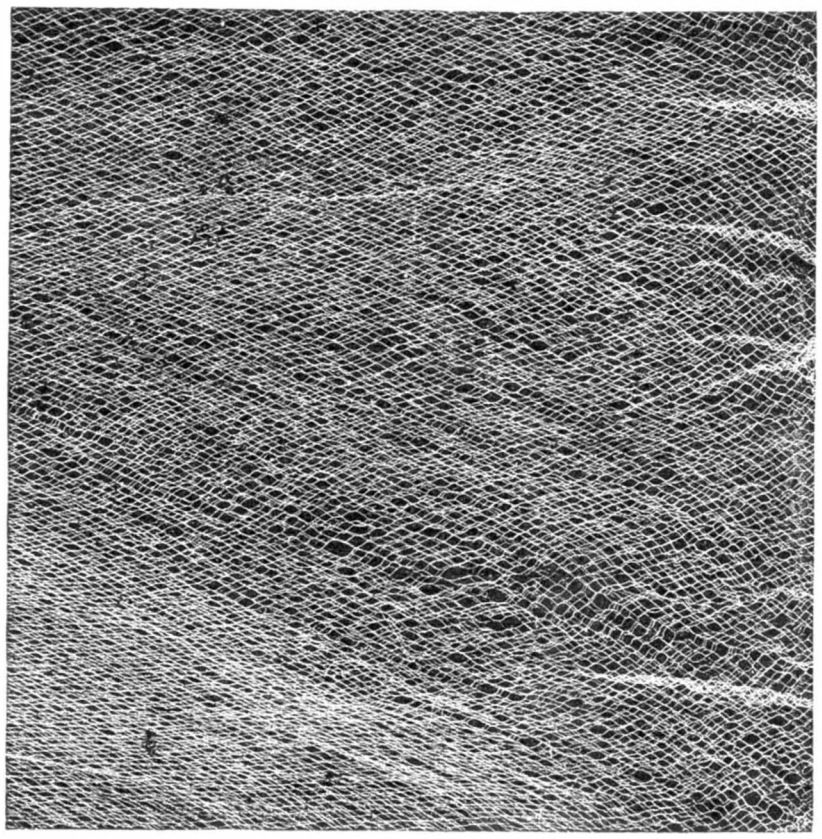
THE LAGETTO, OR LACE-BARK TREE.

The order *Thymelaceæ*, or "Daphnads," comprises a very interesting group of plants, whether we regard them as objects of floral beauty, or look at them from an industrial point of view. The name of the order is derived from *thymelæa*, a plant mentioned by the ancients. The plants included in this group are shrubs or low trees, with entire leaves, perfect flowers, tubular colored calyx, and small round hairy fruit, inclosed in the persistent base of the perianth. They are remarkable for their acrid and caustic bark, the inner portion of which is composed of interlaced fibers, extremely tough, but easily separable, and hence often used for making cordage. The plants of this order occur in great abundance in the cooler parts of India, South America, South Africa, and Australia; a few also occur in Europe. Among the Daphnads may be mentioned the *Gnidia daphnoides*, the bark of which is manufactured in Madagascar into ropes; the *Daphne bholua*, the inner bark of which is made into a soft paper in Nepaul; and *Daphne cannabina*, used for the same purposes in China. The only representative of the order found in North America is our common leatherwood or wicopy (*Dirca palustris*), the bark of which, on account of its great toughness, is used for making ropes, baskets, etc. Among other curious products of Jamaica usually brought home by travelers, specimens of the "vegetable lace" of that island are always sure to be found. The plant which produces this is the *Lagetta lintearia* (formerly called *Daphne lagetta*), or lace-bark tree, otherwise known by the native name of lagetto. It is a small tree, 25 to 30 feet high, growing in the most inaccessible rocky places of the island. Its inner bark consists of numerous concentric layers of fiber, which interlace in every direction, forming fine meshes, and by lateral stretching is made to present a striking resemblance to the most delicate manufactured lace, whence the common name of the tree.

It is said that Charles II. received as a present from the Governor of Jamaica a cravat, frill, and pair of ruffles, made of this material; and, to this day, it is used for bonnets, collars, and other articles of apparel. Travelers state that the Creole women take delight in decorating themselves with this filmy material for evening wear, studding it with the brilliant fire beetles, or *cucujos*, for which the West Indies are noted. The effect is said to be very beautiful.

During the days of slavery in Jamaica, the uses to which this natural lace was applied were not so unobjectionable as those just mentioned, since it then likewise furnished the thongs and whips for the taskmaster's use.

A very perfect representation of a piece of this exquisite vegetable product will be seen in our illustration, which was printed directly on the block from a portion of a very fine specimen kindly sent to us by Robert Nunes, Esq., the U.S. Consul at Falmouth, Jamaica.



THE LACE TREE OF JAMAICA.

Kalameit.

Science has not yet exhausted her store of rewards for those who assiduously devote themselves to her service. This truth is abundantly illustrated in the facts here indicated. For some years an Austrian gentleman, Mr. Julius Sachs, has spent much time and money in the investigation of the nature and properties of the jute plant. Hitherto this article has occupied perhaps the humblest place among textile fibers, but it now bids fair to take a position equal to the best, if the anticipations naturally growing out of the success attending investigations hitherto should be fulfilled. That this will be the case the inventor does not entertain a doubt. The secret of this invention is solely in the hands of the Barrow Flax and Jute Company, and the story of its introduction into this country is briefly as follows:

Mr. Julius Sachs, the inventor, like many predecessors in the same field, discovered that when he had overcome the difficulties attendant upon bringing the invention to scientific completion, he was only at the threshold of another series of difficulties, more disheartening than those already overcome—he could find no one to look favorably upon his discovery. In this contingency he accidentally met with and was introduced to Mr. Edward Jenkins, M.P. for Dundee, who, it was naturally thought, might interest himself in the matter, and bring it under the notice of the manufacturers of that town. Mr. Jenkins did so, but without succeeding in finding any one able and willing to take it up. Nothing daunted, however, by this failure, he next brought it under the notice of the Barrow Flax and Jute Company, with which the Duke of Devonshire and Sir James Ramsden are connected. With that practical foresight which is admittedly so distinguished a feature of Sir James' character, he wished to know more about the matter, and the inventor having been introduced, explanations followed, which, after a visit to Germany to see what had actually been accomplished, terminated in an engagement between Mr. Sachs and the Barrow Flax and Jute Company. This, we have the best authority for stating, is a correct account of the introduction of the invention into this country. In some of our contemporaries it has been stated that the part played by Mr. Edward Jenkins was of a much more important character; but, as will be seen, that gentleman simply acted the part of an intermediary.

Mr. Sachs, installed at Barrow with command of ample means, has for some time assiduously devoted himself to the perfection of the various processes necessary to the new method of preparing the fiber. In this he is aided by a band of German workmen, who have been selected partially from the consideration that linguistic difficulties may interpose some bar to the illegitimate curiosity of outsiders until such times as those who have the best right and property in the invention can make it fully secure, and also because they are so far in advance of English workmen in their knowledge of the art of dyeing. This is very proper care. Many men have suffered from indiscreet revelations of their plans; and their fate at the hands of an ungrateful world has been such that it ought to be a sufficient caution against a repetition of their error.

The fiber of the jute plant is capable of minute subdivision; and in this new industry it is reduced to exceedingly fine filaments—beyond anything effected before. The result is a fine silky material, which takes the dye in a remarkable manner, and so far as experience enables one to judge, the colors are fixed and durable. These qualities are to some extent revealed in the finishing processes to which the fabrics have been subjected. One of the chief difficulties hitherto experienced in the treatment of jute has been to avoid injury to the fiber, especially in bleaching, but this has now been overcome.

It may not be generally known, but it is nevertheless a fact, that the Barrow Flax and Jute Company was established not so much for profit as to form a subsidiary business to the iron trade of the town, and to find employment for the women and children of the men's families engaged therein. It now bids fair, however, to become a great staple industry, and not dependent for support upon its neighbor. The company's operations in connection with the new treatment of jute have emerged from the experimental stage and entered upon the commercial arena. They have hitherto spun the yarn themselves, while the manufacturing operations have been undertaken by Messrs. Critchley, Armstrong & Co., of this city, who have executed their share of the work with the taste and skill for which the firm has long had a great reputation. By their courtesy we have been favored with a private view of duplicates of goods sent to Paris, and also of others that were out of hand too late for the opening day, but which have been forwarded since. The articles hitherto produced consist of curtains, hangings, tablecloths, and dress goods, in plain and figured cloth, some of which, for beauty of design and harmonious arrangement of color, it would be difficult to surpass. In every case a striking feature was the richness and silky luster of the colors, which would have led any uninformed observer to conclude that the fabric was composed of the most esteemed material known in the textile trades, namely, silk, instead of the hitherto despised fibrous portion of the jute plant. Carpets, both tapestry and Brussels, have also been made with equally satisfactory results, and promising experiments have been made with the material in the manufacture of hosiery. The article as applied to textiles has had conferred upon it the name of Kalameit. We hope the labor of the inventor and the enterprise of the capitalists who have embarked in this venture will be amply rewarded, and in this desire we have no doubt we shall have the concurrence of our readers.

Notwithstanding the pleasure we experienced in examining the results of Mr. Sachs' genius, the introduction of what may be looked upon as a new departure in the manufacture of jute, we could not help a slight feeling of regret that it is to a foreigner we are indebted for this new industry. It is, however, only another illustration of the advantages obtained by technical education, which on the Continent is regarded as an absolute necessity, and which the columns of the *Textile Manufacturer* show we have done so much to promote in this country. We can only add that we hope such examples as these will have the effect of rousing English manufacturers from the lethargy into which they have allowed themselves to fall, and which has in matters of taste led them to become mere imitators of our continental neighbors, while in the field of invention we are in danger of being surpassed by our American cousins. This ought not to be, and were its importance properly appreciated, would not be. In the fields of science and invention, for patient, untiring investigation there is an almost certain reward, and to our labor therein depends in the future our command of the markets of the world.—*Textile Manufacturer*.

Resorcine for Cotton Dyeing.

The methods hitherto in use for cotton dyeing with colors derived from resorcine are unsatisfactory both as regards the exhaustion of the bath and the solidity of the shades. The following improved process has been devised by Messrs. Monnet:

The cotton is soaped hot with curd soap for an hour, and then wrung without rinsing.

A solution is made of 8¾ ozs. alum in 35 fluid ozs. of water; it is diluted to 17½ pints; 1¾ oz. of soda crystals is added; the whole is let settle and the clear drawn off. The cotton is immersed in this, and kept at a boil for 10 to 12 hours, and is then passed into a bath containing 17½ pints of water, and from 6¾ to 10¼ ozs. of emulsive oil (such as is suitable for Turkey-red dyeing). Before adding the oil to the bath it should be very well shaken up with 32 fluid ozs. of water. In this liquid the cotton is let steep for one hour, wrung, and dried.

The dye beck is then made up of pure water, 17½ pints; red liquor at 5° Baumé, 7 fluid ozs., with the necessary quantity of color. The dyeing is begun at 122° Fahr., and the beck gradually raised to about 190° Fah. The goods are then allowed to steep till the beck is exhausted, wrung without washing, and dried.

The red liquor is prepared by dissolving 4½ ozs. of alum in 8¾ fluid ozs. of boiling water, and adding a solution of 3⅜ ozs. of sugar of lead in the same bulk of water.

The two solutions are to be mixed, let settle, strained, and the clear is set at 5° Baumé. The greatest care should be exercised to have the water used perfectly free from lime.

Destruction of Yellow Fever Germs.

Two methods have been proposed for destroying the floating germs of yellow fever when the disease is epidemic. One, advocated by Mr. Hardee, of Florida, and suggested by the exemption of the Northern troops in the South during the war of the rebellion, and in Mexico during the Mexican war, involves the destruction of the germs by atmospheric concussion produced by a succession of gunpowder explosions. Mr. Hardee says that the plan was successfully tried last year at Jacksonville, Florida.

The second is proposed by Dr. R. W. James, of Philadelphia, and involves the mechanical production of low temperature. He says, in a letter to the Philadelphia *Ledger*:

"Let every quarantine station have a ward or room capable of holding several patients, more or less, as the exigencies may demand, so arranged that ventilation can be maintained exclusively through ventilators and by means of small anterooms with spring closing doors, and then have no mode of entrance or exit to the ward except through the ante-room. The ante-room should be kept at the same low temperature, or even lower than that in the ward, so that the temperature in the latter may not be raised by the opening and closing of doors by the attendants, nor any of the disease producing germs escape before they are thoroughly subjected to the low temperature and destroyed. The ward and ante-room must be kept at a temperature not higher than 25° Fah. Keep the patients comfortable by a sufficient amount of bed clothing; and everything that goes from the room, such as clothing, excretions, all emanations, etc., must be exposed a sufficient length of time to the cold. This will kill the poisonous germs, or reproducing cause, and prevent, as far as the cases under treatment are concerned, any risk of the disease spreading. If patients cannot bear so much cold during treatment, an adjoining warmer room can be made, with no mode of access or ventilation except through the cold room, and everything going out of the warmer room must be allowed to remain a sufficient length of time to get rid of the contagion. If no attendant occupies the anteroom the degree of cold can be kept near zero, in order the more quickly to destroy all the disease producing agencies."

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PROFESSOR PALMIERI'S DIAGOMETER.

Professor Palmieri's diagometer is an instrument designed to test the quality of oils, and is based upon the principle that olive oil is a poorer conductor of electricity than any other oil in common use, and that mixtures and oils made from seeds are the better the more resistance they offer to the passage of electricity. The oil is poured into a glass vessel, *c*, Fig. 1, in which dip two brass rods, *b b'*. The points of these rods are kept at the same distance apart during the experiments, and also at the same distance below the surface. By means of two arms, *d d'*, the rods are connected with two insulated balls, *f f'*, the former of which communicates with a Zamboni's dry pile, *a*, and the latter with a Palmieri's electrometer, *k*.

In Palmieri's electrometer the electricity, which we will suppose to be positive, passes into a little fined brass cup, *m*, Fig. 2, furnished with brass arms, *p p'*. In the cylindrical cavity of this cup a disk of aluminum is suspended by means of two single threads of silk diverging from a brass hook. The disk has likewise two fine arms, *q q'*, of the same metal. Electricity, contrary to that in the cup, is induced in the disk, and electricity of the same kind is repelled in the arms, *q q'*, in consequence of which the arms or indices of aluminum, situated opposite to those of brass, swing over a graduated circle. The arc described by the index at the first impulse is commonly double that obtained finally when the apparatus is in perfect order. If the final arc is smaller, it indicates that there is some loss of electricity in the apparatus that must be taken into account. This fact gives a peculiar value to Palmieri's electrometer.

If the oil poured into the vessel, *c*, is olive oil, the aluminum index takes several minutes to swing through a few degrees; but if the oil is made from seeds, the index swings through a considerable range in a few seconds. To test the value of oils it is only necessary to compare them at a constant temperature with a sample of pure olive oil, and to note the time required for the index to pass over a given arc in every case.

Palmieri's diagometer may also be employed to detect the presence of cotton in silk fabrics. A strip 0·25 meter long and 0·02 wide is well dried and fastened to the two rods, *b b'*. If it is pure silk, the electricity coming from the globe, *f*, will scarcely move the index; but if it contains cotton, the index will be quickly repelled, and will swing through several degrees.

A. RICCO.

Naples, Italy, July 7, 1878.

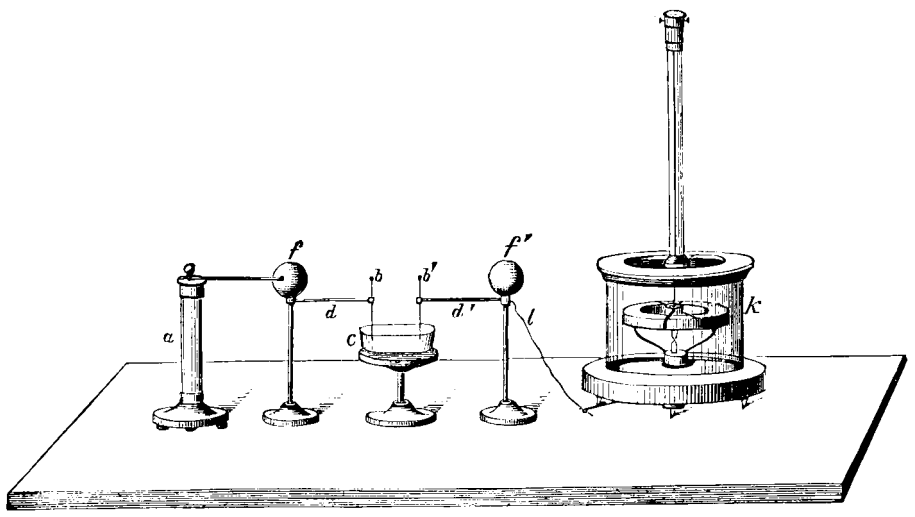


Fig. 1.

PALMIERI'S DIAGOMETER.

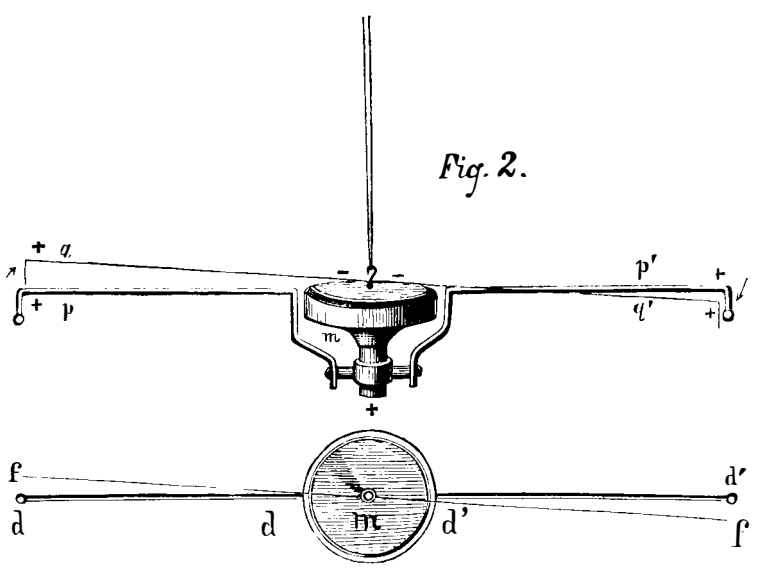
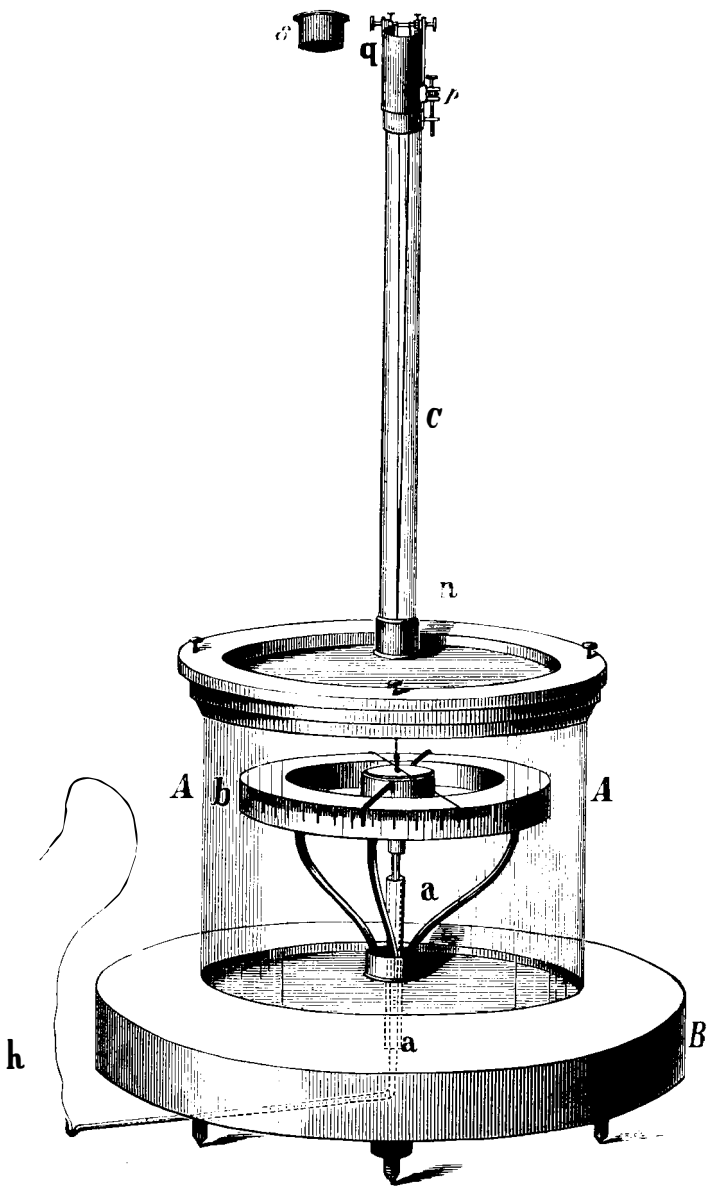


Fig. 2.

ELECTROMETER ARM AND DISK.



PALMIERI'S ELECTROMETER.

New Inventions.

Mr. John P. Bligh, of St. Paul, Minn., has patented an improved Envelope for sending samples of flour, seeds, etc., by mail. It is so constructed as to prevent its contents from sifting out upon the other mail matter, while allowing its said contents to be readily seen.

Mr. James M. Wheeler, of Fish's Eddy, N. Y., is the inventor of an improved Rowlock for boats, and its object is to furnish a simple and durable device which will work easily, and permit the oar to be connected or detached with great facility.

Mr. William H. Parkin, of Good Hope, Ill., has patented an improved End Gate for Wagon Bodies, which is so constructed that it may be conveniently adjusted into an inclined position to enable the contents of the wagon body to be conveniently removed with a scoop or shovel, and which, when in an erect position, will hold the sideboards together and prevent them from being pressed apart by the load.

An improved Heat Fender for Cooking Stoves has been patented by Byron S. Hite, of Fulton, Mo. The object of this invention is to prevent the escape of heat to the room in which the stove is placed, and to confine the heat for the purpose of drying fruit and other articles.

Mr. Joseph T. Maybury, of New Orleans, La., has patented an Apparatus for Drying Meal, Flour, Grain, etc. This invention relates particularly to that class of apparatus known as "steam grain and meal driers," or others of similar construction, extensively used for drying grain, meal, or other like substances, wherein a series of flights or spirals, revolving within cylinders, is made to convey the substance to be dried, while steam is acting on the exterior of the cylinders, and also in the interior of the hollow shafts of said spiral conveyers.

An improved Thill Coupling has been patented by Mr. Winfield S. Palmer, of Glenburn, Pa. The object of this invention is to dispense with the nut usually employed to secure the thill iron of carriage shafts to the clips, and to furnish a coupling which may be applied to the ordinary thill iron and clips without requiring alterations.

An improved Sheet Metal Can has been patented by Messrs. Joseph W. Miller and Bernard Coll, of Baltimore, Md. This improvement consists in stamping the heads of the can with a flange, which is bent, in relation to the cylindrical body portion, first parallel with the same, then flared outwardly, and again bent parallel, so that when the body portion, which is made straight from end to end, is fitted to the heads, the edge of the body portion binds tightly with the inner edge of the smaller portion of the flange, while the outer edge of the flange sets off from the body of the can sufficiently to permit the solder to run in and form a tight joint.

Mr. John W. Turner, of Fort Worth, Texas, has patented a simple and inexpensive Attachment to Counters for Measuring and Cutting Cloth, and holding and cutting twine, and for holding wrapping paper.

Mr. Eugene Hawkes, of San Diego, Cal., is the inventor of an improved Pump, in which two valves are used, working in line with each other, and so arranged that each valve will begin its stroke before the other has quite completed its stroke, to cause each valve to begin to act upon the liquid while moving in the same direction and at about the same velocity, so that there will be no jar or interruption of the discharge, and no loss of force.

Mr. Jacob Bensel, of Stockton Township, N. J., has patented an improved Refrigerator, having a cover made with double walls, inclosing between them a chamber which is supplied with water through a mouth at the top. The base is also made with double walls, inclosing between them a water chamber. The cover rests with its lower edge upon the slightly concave annular surface of the base. Between the inner walls of the cover and the base there is a chamber, in which are placed the substances to be preserved.

Pedro F. Fernandez, of San Juan, Porto Rico, West Indies, has patented an improved Fastening for Holding Doors or Window Shutters securely in position when open, by means of hooks engaging with each other and actuated by springs; and it is applicable to doors and shutters of dwelling houses, doors of churches and places of amusement, and doors on board of vessels.

Mr. John Will, of Bryan, Ohio, has devised an improved Lunch Case for the use of laborers and others, whose employment requires them to carry lunch with them, and for the use of picnic parties, fishing parties, excursionists, etc. It is arranged to carry the lunch securely, and protect it from dust, etc.

Mr. Philipp F. L. Burstall, of Milwaukee, Wis., is the inventor of an improved Burglar Alarm, which may be either portable or fixed, and it may be attached to a door or window, and becomes operative by the jar occasioned by an attempt to open the door or window. The alarm may also be connected by wires to a distant bell or other signal, so as to give the alarm by electricity, and in that manner it is especially available for attachment to safes.

Mr. Miner T. Perkins, of Log Lick, Ky., has devised an improved Branding Stamp, for branding live stock, also rails, posts, and other timber, etc. It is so constructed that it will cancel an old brand at the same time that the new one is formed.

Mr. William R E. Berth, of New York city, has patented an improved Prayer Book and Hymnal Case, made with a central partition provided with pockets upon its opposite sides, to receive the adjacent boards of the covers of the two books, having a flap upon the edge of one side, to overlap and be secured to the other side, and provided with a handle by which it may be conveniently carried.

Mr. Ernst Gessner, of Aue, Saxony, has patented an improvement in Machines for Hot Pressing and Finishing Woven, Felted, and other Fabrics, and made-up articles, such as collars and wristbands. The invention is an improvement upon that general form of machine in which a hollow steam-heated press box smooths and presses the cloth between its curved inner surface and the periphery of an adjacent cylinder

Mr. Moses Lewis, of Utica, Ill., has patented an improved Draught Equalizer, which consists in a novel arrangement of equalizing bars, levers, whiffletrees, and other devices, whereby an apparatus is produced which may be readily adjusted to adapt it to be used with two, three, four, or more horses.

Mr. Henry Hiestand, Jr., of Vincent, Pa., has patented an improved Wagon Jack, in which the sliding bar or standard is placed on the front side of a fixed standard, and the same pins with which the lever engages for raising the bar constitute also the means for guiding the latter in its vertical adjustment. The upper end of the fixed standard is beveled at such an angle that the lever will rest thereon when the sliding bar is locked in any adjustment.

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Mrs. Henry Dormitzer, of New York city, has patented a Window-cleaning Step Chair, which is an improvement on the window-cleaning chair for which letters patent No. 200,441 were granted to the same inventor February 19, 1878. The object of this invention is to render the window-cleaning chair lighter and more portable, to simplify its adjustment, and to render it stronger and more reliable and complete.

The same inventor has also taken out another patent for improvements on the chair, which simplify it so that it may be easily and quickly placed in position in the window and rendered secure.

Messrs. Frank M. Chapin and Joshua Gersbacher, of Cuffey's Cove, Cal., have patented an improved Vehicle Torsion Spring for Wagons, which shall be simple, strong, and durable, and at the same time light and elastic, making the wagon easy riding.

Mr. Magnus Gross, of New York city, has patented a process of Manufacturing Illuminating Gas free from an excess of carbon, carbonic oxide, and light carbureted hydrogen, which consists in passing the commingled steam and hydrocarbon vapors through an incandescent porous material to fix the gases, and periodically turning off the supply of naphtha and blowing out the deposited carbon by means of steam, and conducting the same into the furnace in the form of carbonic oxide and carbureted hydrogen.

Mr. Charles E. Carmon, of Lyons, Ohio, has patented an improved Resonator or Resounding Chamber for Telephones, for the purpose of increasing the tone or sound transmitted to the vibrating diaphragm by means of electricity or any other means; and the invention consists of a hollow resonator, to which the vibrating diaphragm is applied and supported thereon by a metallic band with feet. The post of the resonator is made adjustable in the base for imparting the required tension to the transmitting wire.

Mr. Robert R. Moore, of Lewisville, Ark., has patented an improved Combined Lamp and Stove, which is intended more particularly for the use of physicians, mail messengers, and other persons who, especially in rural districts or thinly settled localities, are compelled in the discharge of their duties to ride on horseback in cold weather, on dark nights, and over rough roads.

Mr. John B. Holmes, of Grayville, Ill., has patented an improved Ventilator for Blow and Dust Rooms. The objects of this invention are, first, to increase the grading capacity of the blow or dust room of a flour mill without changing its size; secondly, to save all the material worth saving, and at the same time to grade it; and, thirdly, to direct the escaping dust downward and outside the mill, so that it may not fall on the roof and cause it to decay.

An improved Bung has been patented by Mr. William Bender, of New York city. This is an improved bung for casks and kegs of all kinds, by which a perfect sealing of the vent hole of the bung is obtained, while at the same time the vent plug is driven in with great facility.

An improved Lock for Firearms has been patented by Mr. John M. Wittman, of St. Mary's, Pa. This invention is an improved attachment for the Winchester repeating rifle. It is so constructed that the rifle may be reloaded by simply pulling a trigger, so that several shots may be fired when required without taking the gun out of aim.

An improved Blasting Wedge has been patented by Mr. Otto F. Brockhausen, of Reno, Nev. The object of this invention is to furnish a simple and effective mode and device for blasting logs or splitting logs by blasting with gunpowder, so as to effect a saving of time, labor, and fuse, as compared with the old method of boring the log and charging the hole with gunpowder.

What Most Women Need.

Discussing the difficult problem of female education, the *Nation* pertinently remarks that what most women need next after health and power of acquisition, and the confidence which springs from having acquired something, is a tolerable amount of administrative capacity. Housekeeping is administration on a small scale. It includes the faculty of getting the most for one's money, and managing servants and children. If it were likely to be a man's vocation to the extent to which it is likely to be a woman's, he would undoubtedly be prepared for it by some sort of apprenticeship. He would have to learn in some subordinate capacity the proper mode of buying and preparing food, and of procuring and taking care of furniture and clothing, and of ruling servants. He would be trained to receive company by some experience of the art of entertaining, both in its material and its æsthetic aspect. No one would ever guess, however, from an inspection of an average school course, that a girl was to be the head of that most complex result of civilization, a modern household, with its thousand duties, responsibilities and relations.

The Secretion of Sweat.

The secretion of sweat is now known to be, like that of saliva, directly under the control of the nervous system, and to be excited by secreting nerves, independently of alterations in the vessels which supply secreting glands. Dr. Ott and Mr. Field, in the *Journal of Physiology*, show that the nerve centers, in connection with the sweat glands, can be stimulated by the poisonous principle of the toadstool—*muscarine*—and that a greater amount of carbonic acid than usual in the circulating blood will also excite functional activity. This fact would tend to explain the well known greater tendency to perspire which people observe when they are shut up in a close room, a tendency which appears to be greater than can readily be accounted for by the warmth of the room alone.

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, September 21, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Mercury rises	4 28 mo.	Uranus rises	3 34 mo.
Venus rises	4 13 mo.	Neptune rises	7 40 eve.
Jupiter in meridian	7 55 eve.	Neptune in meridian	2 30 mo.
Saturn in meridian	11 59 eve.		

FIRST MAGNITUDE STARS, ETC.

	H.M.		H.M.
Alpheratz in meridian	0 02 mo.	Procyon rises	11 44 eve.
Mira (var.) rises	8 22 eve.	Regulus rises	3 17 mo.
Algol (var.) in meridian	3 00 mo.	Spica	invisible
7 stars (Pleiades) rise	8 08 eve.	Arcturus sets	9 19 eve.
Aldebaran rises	9 27 eve.	Antares sets	8 39 eve.
Capella rises	6 55 eve.	Vega in meridian	6 30 eve.
Rigel rises	11 34 eve.	Altair in meridian	7 42 eve.
Betelgeuse rises	11 19 eve.	Deneb in meridian	8 34 eve.
Sirius rises	1 39 mo.	Fomalhaut in meridian	10 47 eve.

REMARKS.

Mercury will be at greatest western elongation west September 25, and will be brightest September 25–28, rising on the 26th at 4h. 25m. morning, about 8° north of the sunrise point. He will be in conjunction with Venus September 25, 5h. 41m. morning, being less than ½° south of her, and as Venus has the greater apparent motion in right ascension, and both bodies are advancing, she will appear east of Mercury after the conjunction. But the hourly motion in right ascension of Mercury increases so rapidly that by September 30 he will overtake her, and be in conjunction again at 9h. 15m. morning, being north of her this time. Jupiter will be stationary September 23. Saturn will be in opposition September 22, being 180° east or west of the sun. Uranus will be near the moon September 24, being nearly 3° north.

The Sun enters the constellation *Virgo* (sign *Libra*) and crosses the equinoctial southward September 22. This is the beginning of Autumn, and the Sun is said to be at the autumnal equinox, but the day and night of the 22d are not of equal duration, as is generally supposed, and stated in astronomical text books.

This year the equal day and night occurs four days after the autumnal equinox, September 26, and at the vernal equinox, three days before, or March 17. This is owing to atmospheric refraction, which increases the length of the day.* This explains why the time of equal day and night occurs before the vernal and after the autumnal equinoxes, for before March 20 the days are less than 12 hours long, as also after September 22.

Disinfectants and Deodorants.

Mr. Thos. Taylor, Microscopist of the Department of Agriculture, gives the following in the Washington *Evening Star:*

During the year 1876 I made a series of experiments with essential oils, including the oil of eucalyptus globulus and the spirits of turpentine, which were published in the report of the Department of Agriculture for that year. I found that the oil of eucalyptus disinfected fresh meat as effectually as carbolic acid, besides being a powerful deodorizer, and on combining it with soap found it agreeable, forming a valuable substitute for the carbolic, especially for the sick room. Turpentine I found to be also a most powerful deodorizer. A tablespoonful of the latter, added to a pailful of water, will destroy the odor of cesspools instantly, and in the sick chamber will prove a powerful auxiliary in the destruction of germs and bad odors, being both a disinfectant and deodorizer. I have quite recently added to the list of disinfectants one of general application, and it has for many purposes the advantage of cheapness with remarkable effectiveness. I allude to gasoline, one of the products of petroleum. Gasoline when applied to the germs of fungi or of other cryptogamic plants instantly destroys them, although it fails to deodorize gases. Being a solvent of oils and fats it destroys animal germs, and fatty degeneration gives way to it. It may be employed full strength to wash delicate and tender plants and sores without producing pain. It is wholly devoid of the caustic principle, even when applied to the tongue; it produces no disagreeable sensation. A single drop applied to any insect will kill it, and even its vapors have a most destructive effect on the lower forms of animal life. When gasoline is applied to a wound or to any delicate part of the body, on evaporation it produces the sensation of cold, followed soon after by a sensation of heat. Of course all experiments should be made in the absence of artificial light, as it is a very explosive gas.

Mail matter supposed to be infected can be thoroughly disinfected by the application of gasoline, either by immersion or by sponging the surfaces. It penetrates with lightning rapidity all porous substances, such as leather, gloves, bank notes, ribbons, dress goods, silk, cotton, and linen, evaporating in a few minutes without injury to the goods. I have placed sealed letters in this solution for a few moments, completely wetting the contents, and in less than five minutes the gasoline evaporated, leaving the letters dry, without stain, and well disinfected.

* From sunrise to sunset is meant.

New Agricultural Inventions.

Mr. James Edgedee Mustard, of Glen Hall, Ind., has patented an improved Wheel Cultivator, which is so constructed that it may have a direct draught, and will have no side draught. It requires less power to draw it than ordinary cultivators.

Messrs. Mortimer Mathews and Albertus L. L. Scoville, of Seneca, Kan., have patented an improved Agricultural Boiler, which consists of a strong wooden barrel containing an iron fireplace and iron flues, and having novel details which render it strong and efficient.

Mr. Willie F. Goddard, of Orwell, Ohio, has patented an improved Hay Elevator and Carrier. This is a simple and effective device for elevating and conveying loads of hay, straw, and other articles.

Mr. Roselle Clarke, of Austin, Minn., has patented an improved Arrangement of Grain Sieves and Wind Vanes, by means of which a rapid and thorough separation of the grain and foreign substances will be effected.

An improved Harrow has been patented by Mr. Samuel Beckner, of Argos, Ind. This harrow is so constructed as to adjust itself to the surface of the ground, harrowing ridges and furrows with the same facility and effectiveness as level ground.

An improved Sack for Baling Hops has been patented by Charles A. Sands, of Burlington, Kan. It consists of a sack, open at both ends and hemmed, and in heads, over which the sack is tied by means of strings drawn through the hems after the hops are compressed.

Mr. Charles A. Sands, of Burlington, Kan., has devised an improved Press for Packing and Baling Hops, by which the hops may be pressed without being broken up or mixed with dust and dirt, and by it more hops can be put in a bale, at a considerable saving in the expense for labor and bagging.

Mr. Thomas S. Miller, of Pomeroy, Ohio, is the inventor of an improved Horse Hay Rake, which consists in an arrangement of levers by which either or both of the brake shoes may be brought into contact with the periphery of the supporting wheels when it is desired to dump the rake.

Mr. Prescott's Proof Sheets and Electrotypes.

To the Editor of the Scientific American:

An article entitled "Crooked Journalism," published in your issue of August 10, charges a writer in the *Engineering* with garbling a portion of my recent work on the speaking telephone, describing Edison's discoveries relating to the acoustic effects produced by the variable resistance of carbon under pressure.

As it might be inferred from the concluding portion of your article that the proof sheets and electrotypes of the portion of my work alluded to were forwarded to an officer of the English Post Office Telegraphs, I desire to correct any misapprehension on this point by stating that they were sent direct to the editor of the *Engineering*.

GEORGE B. PRESCOTT.

Electrician's Office, Western Union Telegraph Company, New York, September 5, 1878.

Explosion of Powder by Lightning.

The recent explosion of two powder magazines by lightning, one attended with considerable loss of life, emphasizes the need of great care in the placing of such structures and in providing them with proper lightning conductors. The first explosion occurred in England, August 8, the magazine belonging to the Victoria Colliery, at Bruntcliffe, and containing one ton of powder. Several persons within range of the explosion were severely injured. The magazine was situated in the middle of a field, 400 yards from the colliery. The shock was terrific, and but for the incessant rain which preceded the explosion, and had the effect of stopping all traffic in the vicinity, many lives, it is thought, would have been lost.

The second explosion occurred near Pottsville, Pa., August 17, the magazine containing 1,100 kegs or 25,000 lbs. of powder. There was a picnic party assembled in the neighboring wood, half a mile distant across a valley. Three were killed instantly and several injured, some fatally. Many houses in the neighborhood were wrecked.

To Render Cinchonia Tasteless.

According to the *American Journal of Medical Sciences*, Dr. S. Ashurst overcomes the disagreeably bitter taste left in the mouth after taking cinchonia, by mixing the alkaloid with sugar of milk and bicarbonate of soda. According to him a powder containing one grain of cinchonia, four grains of sugar of milk and one tenth of a grain of bicarbonate of soda, possesses only the slightly sweet taste of the sugar of milk, and is quite readily miscible with water and milk; or, if preferred, can be easily swallowed dry.

American Institute Exhibition.

This exhibition opens on the 11th day of September, by which date all exhibitors should be in position. The incompleteness of all exhibitions is the cause of general and well deserved complaint, yet we hope our frequent notices of this exhibition may have, at least, the effect of having this one in good shape on opening day. Any parties intending to exhibit should apply at once, and address all communications to General Superintendent, American Institute, New York city.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Vertical Engines, 10 to 15 H. P., thoroughly well made. John Hartrick & Co., 47 Gold street, New York.

Assays of Ores, Analyses of Minerals, Waters, Commercial Articles, etc. Technical formulæ and processes. Laboratory, 33 Park Row, N. Y. Fuller & Stillman.

The improved Gatling Guns fire over 1,000 shots per minute, and are the most destructive war weapons ever invented. Gatling Gun Co., Hartford, Conn., U. S. A.

For Town and Village use, comb'd Hand Fire Engine & Hose Carriage, $350. Forsaith & Co., Manchester, N. H.

Blowers.—One No. 5, two No. 6, regular pattern, steel, pressure Sturtevants; one No. 6, Hot Blast Apparatus; also other sizes for sale very low. Exeter Machine Works, 140 Congress St., Boston, Mass.

Solid Walrus Wheels. Wood Wheels Covered. Fine Wool Felt Wheels for Polishing. Greene, Tweed & Co.

Magneto Call Bells for Telephone Lines. The Best. No battery required. Bunnell, 112 Liberty street, N. Y.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

For Sale.—Entire interest in a valuable Patent. Will command a large sale, and is the best instrument of its kind now in use. Call or address W. H. Rodgers, No. 96 Fulton St., room 5.

Wm. Sellers & Co., Phila., have introduced a new Injector, worked by a single motion of a lever.

Megaphonic Telephones.—Something new. Send stamp for circular. Redett & Sons, Fredericksburg, O.

Address Star Tool Co., Providence, R. I., for Screw Cutting Engine Lathes of 13, 15, 18, and 21 in. swing.

Wanted —A reliable, honest, temperate man, and qualified to manage a Store in New York supplied with Engines and Boilers. Answer Drawer 50, Erie, Pa.

Use the Patent Improved Sheet Iron Roofing and Drip Crimped Siding made by A. Northrup & Co., Pittsburg, Pa. Send for circular and prices.

Engine Builders' Brass Goods, Oil Feeders, Glass Oil Cups, Shaft Cups. All goods strictly first class. Address Cincinnati Brass Works.

Dead Pulleys, that stop the running of Loose Pulleys and Belts, taking the strain from Line Shaft when Machine is not in use. Taper Sleeve Pulley Works, Erie, Pa.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N.J. English Agency, 18 Caroline St., Birmingham,

Write to E. & F. Gleason, 56 Canal street, Philadelphia, for standard wood tools,

Sperm Oil, Pure. Wm. F. Nye, New Bedford, Mass.

Diamond Planers. J. Dickinson, 64 Nassau St., N. Y.

North's Lathe Dog. 347 N. 4th St., Philadelphia, Pa.

Telephones.—J.H. Bunnell, 112 Liberty St., New York.

J. C. Hoadley, Consulting Engineer and Mechanical and Scientific Expert, Lawrence, Mass.

Boilers ready for shipment, new and 2d hand. For a good boiler, send to Hilles & Jones, Wilmington, Del.

Punching Presses, Drop Hammers, and Dies for working Metals, etc. The Stiles & Parker Press Co., Middletown, Conn.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

1,000 2d hand machines for sale. Send stamp for descriptive price list. Forsaith & Co., Manchester, N. H.

Presses, Dies, and Tools for working Sheet Metals, etc. Fruit and other Can Tools. Bliss & Williams, Brooklyn N. Y., and Paris Exposition, 1878.

The Cameron Steam Pump mounted in Phosphor Bronze is an indestructible machine. See advertisement.

Manufacturers of Improved Goods who desire to build up a lucrative foreign trade, will do well to insert a well displayed advertisement in the SCIENTIFIC AMERICAN Export Edition. This paper has a very large foreign circulation.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Improved Wood-working Machinery made by Walker Bros., 73 and 75 Laurel St., Philadelphia, Pa.

Special Planers for Jointing and Surfacing, Band and Scroll Saws, Universal Wood-workers, etc., manufactured by Bentel, Margedant & Co., Hamilton, Ohio.

Water Wheels, increased power. O.J. Bollinger, York, Pa.

We make steel castings from ¼ to 10,000 lbs. weight, 3 times as strong as cast iron. 12,000 Crank Shafts of this steel now running and proved superior to wrought iron. Circulars and price list free. Address Chester Steel Castings Co., Evelina St., Philadelphia, Pa.

Machine Cut Brass Gear Wheels for Models, etc. (new list). Models, experimental work, and machine work generally. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Elevators, Freight and Passenger, Shafting, Pulleys, and Hangers. L. S. Graves & Son, Rochester, N. Y.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in Scientific American of last week.

Self-feeding Upright Drilling Machine of superior construction; drills holes from ⅛ to ¾ inch diameter. Pratt & Whitney Co., Manfrs., Hartford, Conn.

Wheels and Pinions, heavy and light, remarkably strong and durable. Especially suited for sugar mills and similar work. Pittsburgh Steel Casting Company, Pittsburgh, Pa.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St. Wm. Sellers & Co.

The Turbine Wheel made by Risdon & Co., Mt. Holly, N.J., gave the best results at Centennial test.

Blake's Belt Studs are the strongest fastening for Rubber or Leather Belts Greene, Tweed & Co., 18 Park Place, N. Y.

Bolt Forging Machine & Power Hammers a specialty. Send for circulars. Forsaith & Co., Manchester, N. H.

An exhibition of the Forster-Firmin system of Amalgamating Metals will be given at Norristown, Pa., on September 13, 17, and 20. Circulars and cards of admission can be obtained at the offices of the company, 320 DeKalb St., Norristown, Pa.

For sale low.—Set Optician's Tools. Young, 43 N. 7th St., Philadelphia, Pa.

For Sale.—The factory property, 3 acres of ground inclosed by iron fence, factory building three and four stories, 250 feet front, with wing 40 x 90 feet, lately occupied by the United States Watch Company, at Marion Station, on the Pennsylvania Railroad, in Jersey City; also for sale the complete machinery of watch factory. Address P. O. Box 3100, New York city.

Notes & Queries

(1) J. R. asks for a recipe for staining wood dark mahogany, cherry, or rosewood color, something that will not have to be applied hot. A. 1. Boil ½ lb. logwood in 3 pints of water, and add ½ oz. salt of tartar. 2. Boil ½ lb. madder and ¼ lb. fustic in 1 gallon water. 3. Boil 1 lb. Brazil wood and 1 oz. of washing soda in 1 gallon of water, apply, and then brush over it before dry a solution of 2 ozs. alum in 1 quart of water. With these wood, if dry, may be stained in the cold; but the dyeing will be accomplished far more quickly and satisfactorily if the liquids are applied hot.

(2) J. M. B. asks: What is the difference between nitro-glycerin and tri-nitro-glycerin, and their formulæ? A. The name nitro-glycerin is generally restricted to the tri-nitro-glycerin—$C_3H_5(NO_2)_3O_3$—in which three atoms of hydrogen are replaced by three of nitryl (NO_2). It is the most stable and powerful, when properly exploded, of the nitryl substitution products of glycerin.

1. What is the authority for the observance of Saturday as the Sabbath? A. Gen. ii., 1st to 3d; Ex. xx., 8th to 11th; Matt. v., 17th, 18th; Rom. iii., 31st; Luke xxiii., 56th; Acts xiii., 14th-44th; xvi., 13th; xvii., 2d. 2. What is the authority for the observance of Sunday as the Sabbath? A. Encyc. Brit., art. Sunday; Kitto, Cyc. Bib. Lit., art. Lord's Day; Smith's Bible Dict., art. Lord's Day; Heylin's Eccl. Hist., part 2, I. 12.

(3) E. L. B. asks how to prepare a salicylic mouth wash. A. 3 parts salicylic acid dissolved in 1,000 parts of water is the usual strength. The continued use of these solutions (of salicylic acid) as a dentifrice has proved very detrimental to the teeth.

Please oblige me by stating the properties of salicylate of soda. A. It is a white, inodorous body, soluble in water, weakly resembling the acid in its antiseptic properties.

(4) A. K. asks for a chemical test by which to determine the amount of chloride of silver, the amount of sulphate of silver, and the amount of sulphuret of silver contained in a sample of ore that has been chloridized by heat in contact with salt. A. The chlorinization assay is made as follows: Weigh out two samples of the chloridized ore or "pulp," each 2·916 grammes, scorify one with 30 grammes of lead, and cupel. Place the second sample in a filter paper, and wash with a strong aqueous solution of sodium hyposulphite (2 lbs. to the gallon), until all the silver chloride has been leached out (when a drop of sodium sulphide solution no longer occasions a precipitate or brown color when brought into contact with a drop of the filtrate). Wash the residue with water, ignite it, mix with 30 grammes of pure lead, scorify, and cupel. Then, weight of bead No. 1: (bead No. 1—bead No. 2) :: 100 : x = per cent of silver chloridized, and 100 — x = per cent not chloridized. There are no ready means by which the amounts of silver combined with sulphur and sulphuric acid in the average of silver ores may be satisfactorily ascertained.

(5) F. B. A., J. L., and others: For waterproof cement. 1. Soak pure glue in water until it is soft; then dissolve it in the smallest possible amount of proof spirit by the aid of a gentle heat. In 2 ozs. of this mixture dissolve 10 grains of gum ammoniacum, and while still liquid add half a drachm of mastic dissolved in 3 drachms of rectified spirit. Stir well, and for use keep the cement liquefied in a covered vessel over a hot water bath. 2. Shellac, 4 ozs.; borax, 1 oz.; boil in a little water until dissolved, and concentrate by heat to a paste. 3. Ten parts of carbon disulphide and one part oil of turpentine are mixed, and as much gutta percha added as will readily dissolve. 4. Melt together equal parts of pitch and gutta percha, apply warm, and press the parts firmly together until quite cold. 5. The ordinary marine glue consists of caoutchouc 1 oz.; genuine asphaltum, 2 ozs.; benzole or naphtha, q. s. The caoutchouc is first dissolved by digestion and occasional agitation, and the asphalt gradually added. The solution should have about the consistence of molasses.

(6) B. A. W. asks for a recipe for a gold lacquer or varnish that gilt moulding manufacturers use on gilt moulding to make silver leaf and bronze look like gold. A. Seedlac, 3 ozs.; turmeric, 1 oz.; dragon's blood, ¼ oz.; alcohol, 1 pint; digest together for a week, with frequent shaking, decant and filter. It is customary to dissolve the resins (pale lac or sandarac) and the coloring matters separately, so that at any time a lacquer of a given tint may be produced by their mixture. The solutions of coloring matters should be concentrated.

Please give recipe for a fluid to repolish silver plated coffin trimmings that have been plated, but have tarnished by the action of air. A. Such work is best polished by moistened whiting, tripoli, or rouge. Solution of potassium cyanide is sometimes employed, but is not to be recommended.

(7) T. T. writes: We have an old 60 horse power engine which is considerably eaten out under the steam chest, so that it will not hold a rubber gasket. Now I would like to know the best manner of making a joint. We tried a rust joint, but a part of it blew out in a few weeks, which I have kept closed by driving in sheet lead with a calking tool. Would lead run in and then calked make a lasting joint? Or can rust be so prepared that tallow or cylinder oil will not eat it out, or is there any better way? A. We think you can make a good job with the lead. A properly made rust joint will also answer. 2. Through some mistake in putting in a new crank, the piston has about ¾ or 1 inch clearance on each end; would it pay to have plates put on the cylinder heads or piston head to fill these spaces, or would there be danger of them coming loose and falling down? A. It would be advantageous in some respects, and there is no difficulty in securing the plates. 3. Would a pond of 75 by 200 feet and 4 feet deep be large enough to supply a condenser for aforesaid engine, supposing the water from the condenser to run through 300 feet of spouting back into the pond? A. Yes. 4. Are condensing engines (such as the Corliss) made so the condenser can be used or not at pleasure? A. Yes. 5. I have some 3 inch boiler flues and some 2½ inch gas pipe; could I make a cheap portable boiler out of either or both, for a 1½ by 3 engine? If so, how shall I proceed? A. You can make a sectional boiler by securing the tubes at each end to hollow castings.

Is my handwriting good enough for a bookkeeper, or would it be objected to? Is it of a kind that will improve by practice? A. As a general thing bookkeepers are required to write rather better; but you can improve your handwriting by practice.

(8) W. M. S. asks: What is the difference between the locomotives used for passenger trains and those used for freight trains, and where the difference of power lies? A. Generally freight locomotives have smaller driving wheels than passenger locomotives, or larger cylinders, or both.

Also, whether a boat at anchor swings with the wind or tide? A. With whichever is the most powerful, we imagine, but usually with the tide.

(9) J. B. C. asks for the name of some book on the engine used by the U. S. Navy, or describing the "Screw or Propeller Engine." A. You will find illustrations of marine engines and boilers and propellers in Burgh's "Modern Marine Propulsion" and "Marine Compound Engines," also in Bourne's "Treatise on Screw Propellers."

(10) A. K. D. asks: Can you inform me of the easiest and least expensive process to polish surfaces of hard stones, say agates? A. You will find the process given in detail in Byrne's "Handbook for Artisans, etc."

(11) J. L. W. asks: Does the successful working of a hydraulic ram depend upon any power not generated or gained by or from the momentum of the water in the pipe leading from the spring to the ram, or does the air in the air chamber have any power of its own? A. The air chamber does not generate any power, but a ram does not usually work successfully without it. You may find some analogy in the flywheel of a steam engine, which, while it does not generate any power, alternately accumulates and gives it out.

(12) A. R. asks: What is meant by the indicator card of an engine? A. The indicator card from an engine is a diagram showing the pressure of steam at every point of the stroke.

Please tell me when Cooper Institute opens for night session, and how I can get registered in class for civil engineering. A. For information in regard to Cooper Institute, call on or address the secretary.

(13) C. W. W. asks how to find the horse power of an engine. A. The horse power of an engine can only be determined by experiment, since the mean pressure of the cylinder must be known. 2. How large a pleasure boat will a one horse power engine run at the rate of a mile in about ten minutes, with screw propeller, and also the size of the propeller? A. Make a boat 15 feet long, with a screw 20 inches in diameter and 30 inches pitch.

(14) P. J. M. asks: What quantity of water can be condensed on one superficial foot of cooling surface in an hour in a surface condenser, the steam entering condenser from a boiler wherein the pressure is, say, 70 lbs., condenser being well supplied with the ordinary sea water? A. From 10 to 12 lbs. in ordinary practice, although much better results have been obtained in special cases.

(15) E. O. H. asks: What ingredient shall I use in a solution to clean clay soil from marble tombstones? A. Wash it with water, apply a mixture of 3 parts sodium carbonate (sal soda) and two parts caustic lime made into a paste with water; after a time wash this off thoroughly, using a stiff brush.

Please give recipe for a reliable shoe gloss. A. Shaw's patent blacking is made as follows: Soft water, 1 gallon; logwood extract, 6 ozs.; dissolve by gentle heat; soft water, 1 gallon; borax, 6 ozs.; shellac, 1½ oz., boil until solution is effected; potassium dichromate, ¾ oz.; water, ½ pint; dissolve, and add all together. It is preferred to add to this before boiling 3 ozs. of spirit of ammonia or aqua ammonia.

Does the moon's eclipse have any effect whatever on the weather? A. No.

(16) C. M. H. asks: 1. What is gas carbon (such as is used in the electric lamp)? A. It is similar to that used in batteries. See pp. 60 (40), 189 (2), and 203 (2), vol. 37, SCIENTIFIC AMERICAN. 2. Will lampblack pressed or moulded into sticks answer for carbon pencils for trying Hughes' and Edison's experiments? A. Yes.

(17) C. S. ÷ is a division mark. You should buy an elementary book on arithmetic.

(18) T. G. P. asks: What are the materials used for flavoring smoking tobacco, and, if possible, as to the manner of its preparation? A. Consult "Handbuchdes Tabaks," and "Cigarrenfabrikation mit besonderer Berücksichtigung der im Handel vorkommen den Tabaksorten, deren Zubereitung, etc.," by L. von Wagner.

(19) H. E. H. asks (1) how to find the proper size and weight of flywheel for an engine, and if the rule is the same in upright and horizontal engines, and also give example. A. Let r = radius of wheel, measured to the middle of the rim, in feet. N = revolutions per minute. v = velocity of point whose radius is r, in feet per second. P = horse power of engine. E = ratio of greatest fluctuation in power during stroke, to mean power exerted during stroke. Then the weight of the flywheel in pounds varies, according to the nicety of the regulation required, from 1,000 to 2,000 times $\frac{P \times 33{,}000}{v^2 \times N.}$ 2. How do we make an engine run a certain number of revolutions per minute? A. The most common method is a governor, which supplies or shuts off steam as required.

(20) J. E. W. asks for the best method to prevent a new upright boiler from foaming. The first two or three days they run they foam badly, and we would like to prevent it. A. Frequent blowing off and throttling the steam are often efficacious.

(21) G. A. C. writes: My boiler is 9 x 30 inches, with 5 flues. Size of cylinder 2¾ x 4 inches. With 40 lbs. steam it runs a small lathe and jig saw, one at a time, very well. Would it run a 6 inch rip saw if I ran the belt directly from a 7 inch pulley on the engine to a 2 inch pulley on the saw, running engine at 300? A. We think so. 2. Boiler made of $\frac{3}{16}$ iron, is it safe at 100 lbs. pressure? A. Yes.

(22) J. E. H. asks: Does the top of a carriage wheel move faster than the bottom when the carriage is in motion? If so, does the point of contact with the earth come to a full stop? A. Faster with reference to external objects; at the same speed with reference to a point on the wagon.

(23) W. C. S. writes: With steam at 60 lbs., what horse power will be developed in two horizontal boilers, each being 16 feet long by 58 inches in diameter, and each having 34 four inch flues? What power with 80 lbs.? A. As we have frequently stated, there is no standard for the horse power of a boiler. If these boilers are properly set they should evaporate at least 7 or 8 lbs. of water for each pound of coal burned.

(24) A. B. P. writes: I kept some sulphuric acid in a large bottle for several weeks. On examination I found that it smelled strongly of SO_2. What is the reason? A. Probably to the presence of organic matter in the boiler.

A friend of mine had a bottle of moist potassium cyanide. It stood aside for some time. On opening it he found that the odor of the cyanide had disappeared and was replaced by that of ammonia. What was the reason of that? A. Potassium cyanide is decomposed by the feeblest acids, even the carbonic acid of the atmosphere; and the unstable hydrogen cyanide set free soon suffers decomposition, ammonia being one of the products.

(25) B. G. writes: 1. Having bought a steam engine for grinding cider apples and other farming purposes for my own use, will I have to have a license to run the same? A. We think not. 2. If I fill the boiler with water and heat it so that the gauge rises to 100 lbs., will it be safe to carry steam 75 lbs.? A. Yes, if no imperfections are developed on the trial.

(26) P. P. P. asks (1) for the rule or operation necessary to determine the correct pitch of screw propellers. A. Make it from 1½ to 1¾ time the diamter. 2. Also the rule to obtain the wheels to cut ½, 1¼, or 2½, and all odd threads in a screw cutting lathe. A. See articles on "Practical Mechanism," by Joshua Rose. 3. Is the diameter of a propeller taken from the tip of the blades? A. Yes.

(27) G. A. R. asks what the substance was that fell with the rain some six weeks ago. It looked like sulphur, and fell quite abundantly in New England and in parts of New York State. A. It is the pollen of the common white pine—*Pinus strobus*.

(28) J. J. D. asks: 1. What size of ports is required in engine 7 inches bore and 12 inches stroke? A. Make them one tenth of piston area. 2. Should there be any more than the thickness of the port between the piston and cylinder head when the crank is on dead centers? A. No; it should be much less. 3. What size of return tube boiler would I require for cylinder that size, and what power would I have? A. A boiler 30 inches in diameter and 9 feet long will answer. The engine might develop 10 horse power.

(29) T. C. writes: The tube sent you was taken out of an upright tubular boiler, 30 inches in diameter and 4 feet high, and one year old, belonging to a launch, 30 feet long, fitted with a pipe condenser made of galvanized iron pipe, in which fresh water was used. The oil used in the cylinder was lard oil. The part of tube wasted away is the top. What do you think was the cause of it? Was it the oil used or the water? A. It was probably due to the grease. By allowing a slight scale to form in the boiler the action may be prevented, and possibly a piece of zinc suspended in the boiler will have the same effect.

(30) F. S. asks: Would it not be injurious to a horizontal boiler to extend the fire space above the waterline? I see it advocated in the SCIENTIFIC AMERICAN, although contrary to usual practice. A. The plan we have recommended is one in very common use, with no injurious results.

(31) L. S. W. asks: Which requires the most power—for a horse to walk up an inclined plane, 100 slope and 20 feet rise, or to walk on a "horse power" with the same rise as the hill or inclined plane, until 100 feet of power surface had passed under him? A. As we understand your question, there will be no difference.

(32) J. B. writes: I have a well on top of a hill that is 30 feet deep, vein of water strong, will have to go 500 feet down the hill to get level with the bottom of the well. Can I draw the water with a siphon successfully? Will size of pipe make any difference? A. You can use a siphon if provision is made for removing the air at all high points. The size of pipe to be used depends upon the delivery required.

(33) A. M. writes: I have a steam launch 25 feet long, 6 feet beam, with a double engine; each cylinder 3¼ bore by 3½ stroke. Boiler carries 120 lbs. Wheel 23 inches diameter, 28 inches pitch, making 585 revolutions per minute. Speed of boat without injecting water into boiler is fully 9 miles per hour, but as soon as injector is started the steam drops somewhat and reduces her speed. When running at full speed her bow rises and stern drops down, notwithstanding the shaft has a good rate downward. If I built another

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boat for this engine and boiler, say 8 or 10 feet longer, do you think I would get more speed? What dimensions would you recommend a boat to be to get the most speed out of my engine and boiler? A. It is somewhat questionable whether you will be able to make much improvement on the present performance with another boat and the same machinery. With a larger screw and the present boat you might do somewhat better.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure the receipt of original papers and contributions on the following subjects:

The Telephone. By S. F. P.

The Microphone. By W. L. S.

The Gyroscope as applied to Vessels. By R. L.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Many of our correspondents make inquiries which cannot properly be answered in these columns. Such inquiries, if signed by initials only, are liable to be cast into the waste basket.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

[OFFICIAL.]

INDEX OF INVENTIONS

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A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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Liquid meter.—L. W. Boynton, Hartford, Conn.
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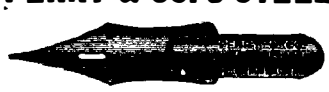

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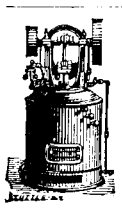

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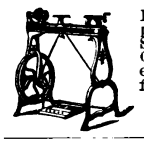

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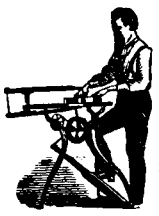

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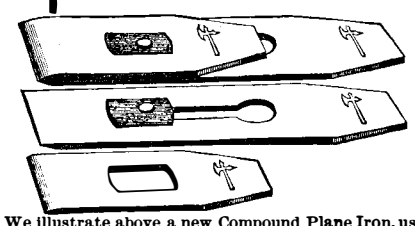

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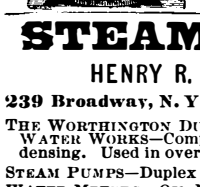

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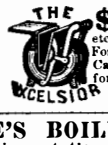

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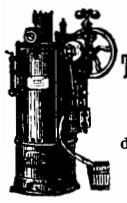

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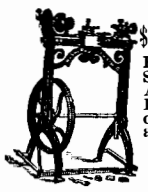

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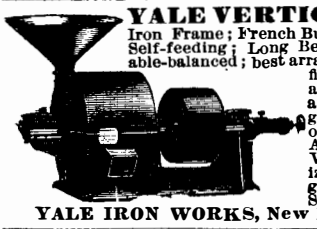

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